# CONCEPTUAL WORK PLAN
# ALTERNATE REMEDY

## ACS NPL SITE
## GRIFFITH, INDIANA

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# EXECUTIVE SUMMARY

The ACS site is a 33-acre parcel of land, including a currently active chemical manufacturing plant located at 420 South Colfax Avenue in Griffith, in the northwest corner of Indiana. The Site began reclaiming spent solvent wastes in 1955, and continues to manufacture specialty chemicals. Based on the findings of an RI/FS and subsequent studies and groundwater sampling, three primary contaminant source areas have been identified at the Site: the On-Site Containment Area, the Still Bottoms Pond Area, and the Off-Site Containment Area. Identified contaminants of concern include volatile organic compounds ("VOCs") in the soil and groundwater and PCBs in the soil. This Site was placed on the National Priorities List in 1984 and a Record of Decision ("ROD") was issued on September 30, 1992. The ROD specified groundwater pump-and-treat, low temperature thermal treatment ("LTTT") of buried waste and contaminated soils, in-situ vapor extraction ("ISVE") of contaminated soils, drum removal from the On-Site Containment Area and groundwater monitoring for remedial action at the Site. This document outlines an alternate remedial action which replaces the LTTT with a more extensive containment and ISVE application which is equally protective, and more technically and cost effective than the LTTT.

Groundwater pump-and-treat and groundwater monitoring have already been implemented to some extent at the site. In addition, a polyethylene and bentonite slurry containment barrier was constructed around the Site source areas. One foot of clay cover has also been placed on the Off-Site Containment Area. These containment measures effectively isolate the source areas from further contaminating the groundwater. In response to the ROD requirement for LTTT, a materials handling and LTTT study were undertaken to determine the feasibility of LTTT at the Site. The results of the study determined that even though LTTT can be effective at treating organic compounds, implementing the technology at the ACS Site would be extremely difficult based on complications with buried debris, municipal waste, fugitive vapor loss, and potential for explosions during excavation and treatment. Therefore, an alternate to manage the organics at the Site needed to be developed.

The alternate remedy incorporates the groundwater pump-and-treat and ISVE requirements of the ROD, and will meet the general remedial objectives of the ROD. The alternate remedy approach includes the following components:

- Enhancement of the current containment systems in the Still Bottoms Pond and Off-Site Containment Areas by covering to reduce infiltration and prevent direct contact with contaminants.

- Mass removal of mobile VOC contaminants through the use of ISVE in the Still Bottoms Pond and Off-Site Containment Areas.

- Elimination of a primary potential source of contaminants by excavating drums from the On-Site Containment Area and disposing of the contents off-site.

- Removal of the PCB-impacted sediments in the wetlands area by excavating sediments and consolidating them on-site in a contained area.

- Continued operation of the groundwater pump and treat system.

- Enhanced bio-remediation and long term monitoring of the contaminated groundwater at the Site

Application of ISVE to remove VOC contaminants will be conducted first in the Off-Site Area, where there is sufficient vadose zone to implement ISVE. In addition, the water table will be lowered in this area while the ISVE system is running to expose additional contaminants to the ISVE and thereby increase the mass of VOCs removed. A phased approach to ISVE start-up will be implemented, so that the vapor treatment system for the ISVE system can be optimized and operated as efficiently as possible. Once the ISVE system is optimized with the lowered water table in the Off-Site Containment Area, the ISVE system will be applied to the second significant source area; the Still Bottoms Pond Area. The water table will also be lowered in this area to increase the effectiveness of the ISVE application. Again, a phased approach to start-up will be conducted to maximize the treatment system efficiency and optimize contaminant recovery.

Both the Still Bottoms Pond Area and the Off-Site Containment Area will be covered with an impervious material which will provide a surface seal for the ISVE system, reduce infiltration of rainwater and prevent direct contact with exposure to contaminants and vapors from those contaminants. The initial cover layers will be installed as part of the start-up of the ISVE systems. Once the ISVE systems are in place and have been optimized, the final layers of the covers will be installed.

The ISVE system will continue to be applied to the two contaminated soils areas, the Off-Site Containment Area and the Still Bottom Pond Area, until data indicates that the system is no longer removing significant masses of contaminants as demonstrated by reaching the asymptotic limit of the VOC recovery rate. Current estimates indicate that the systems will be applied for approximately 10 years, and pulsing or other operational modifications will be considered to maximize efficiency and minimize supplemental fuel use, reducing the total emissions from the off-gas treatment system(s).

Coordination of the remedial actions with the ongoing chemical plant operations will be required as long as the chemical plant continues to operate on-Site. The chemical plant currently uses the Still Bottoms Pond Area and several adjacent areas, which will be covered and treated with ISVE, for transport and some operations. The need to modify the remedial actions to accommodate continued operation of the plant may result in modified work schedules and costs.

The alternate remedy is a robust system, capable of complying with the ROD objectives for remedial action at the Site. The combination of continued groundwater pumping and treatment, covering for containment, ISVE for source reduction, and source removal in the On-Site Containment Area and wetlands, will adequately address the risks at the Site.

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# 1.0 INTRODUCTION

This document presents the conceptual design for an alternate final remedy at the American Chemical Service (ACS) site. The ACS site is a 33-acre parcel of land, including an active chemical manufacturing plant located at 420 South Colfax Avenue in Griffith, in the northwest corner of Indiana. This Site was placed on the National Priorities List in 1984 and a Record of Decision (ROD) was issued on September 30, 1992. The ROD required treatability studies and indicated Low-Temperature Thermal Treatment (LTTT) would be used for treatment of buried waste in the Off-site Containment Area and for VOC contaminated soil unable to be treated by in-situ soil vapor extraction (ISVE). The results of the 1997 Material Handling and LTTT treatability studies (1,2) showed that LTTT treatment would not safely achieve the goals of the ROD. Therefore, at the request of U.S. EPA, an alternate final remedy has been developed.

## 1.1 SITE LOCATION AND SURROUNDING AREA

The Site is bordered on the east and northeast by Colfax Avenue as shown on Figure 1. An abandoned leg of the Chesapeake and Ohio Railway bisects the Site in a northwest-southeast direction, between the fenced ACS operating facility (north) and the fenced Off-Site Containment Area (south). ACS now owns these tracks and operates them strictly for holding and switching tank cars. The Site is bordered on the south by the Griffith Municipal Landfill (closed) and the abandoned Erie and Lackawanna Railway. On the north, the Site is bordered by the Grand Trunk Railroad and to the west by wetlands areas.

Approximately 33 acres are present within the Site, with the on-site area (ACS operating facility) covering 15 acres, and the Off-Site Containment Area and Kapica-Pazmey Area (at the southern end of the Site, where a former drum recycler was located) covering 13 acres. The wetlands to the west of the Site make up approximately 5 acres.

## 1.2 SITE BACKGROUND

The site began operations in 1955, with reclamation of spent solvent waste. The site accepted solvent mixtures containing alcohols, ketones, esters, chlorinateds, aromatics, aliphatics, and glycols which contained various residues. Other processes that have operated at the site since 1955 include specialty chemical manufacturing in small batches, burning of still bottoms and non-reclaimable materials in incinerators (1965-1970), epoxidation and bromination operations, and storage and blending of waste streams for ACS's secondary fuel program.

The approximate area of drum storage was a 250-foot by 450-foot parcel, located in the northern third of the fenced ACS facility. The drum storage area was visible in a 1970 aerial photograph. However, an aerial photograph from 1973 indicates that the area was clear with no sign of drums on the ground surface. Approximately 400 drums containing sludge and semi-solids of unknown types were reportedly disposed of inside the plant (this area was named the "On-Site Containment Area")

From 1988 to 1992, a Remedial Investigation/Feasibility Study was conducted at the Site. In 1992, a ROD was executed which described the remedial action to be implemented on the site. The remedial action identified in the ROD is discussed in Section 2 of this Plan.

During the RI in the late 1980s, a test pit was excavated in the On-Site Containment Area, where drums were thought to be buried. Drums were found to be buried on their sides, stacked 3-high and closely packed together. Various liquids were observed in soil surrounding some of the drums, such as brownish water, and an oil-like liquid. In addition, a viscous blue liquid was observed leaking from several drums. The majority of the drums were noted to be dented and corroded, but largely intact. Construction activities conducted during installation of the Perimeter Groundwater Containment System (PGCS) and Barrier Wall Extraction System (BWES) verified the presence of buried drums stacked 3-high in the On-Site Containment Area. A geophysical investigation was subsequently conducted in February 1998 to determine the extent of the buried drums in the On-Site Containment Area. Based on past RI results, recent construction activities, and the 1998 geophysical investigation, two areas of buried drums were identified, and are shown on Figure 1.

The Still Bottoms Pond Area, located in the central portion of the ACS facility, served as a repository for still bottoms waste from the solvent recycling process. This area contained a pond and "treatment lagoon" where still bottoms were disposed. The pond and lagoon have since been filled in with drum carcasses, rubble, soil, and other debris. During the RI, many borings were advanced in this area, and the concentrations of contaminants in the area indicate that it is a significant source area on Site. Further description of the extent of contamination is included in Section 1.3.

The wetlands to the west of the ACS facility were investigated in 1996 to determine the extent of impact from facility operation on the wetlands. Analytical samples collected during this investigation indicated that certain localized sediments in the wetlands area were contaminated with polychlorinated biphenyls (PCBs). These PCBs likely were transported from the facility via surface water runoff from the facility which drained into the wetlands areas.

The Off-Site Area of the Site is located south of the ACS facility railroad tracks and encompasses the Off-Site Containment Area and the Kapica-Pazmey building area. A large portion of the Off-Site Area is essentially a continuation of the Town of Griffith landfill. During the RI, installation of soil borings indicated contaminated areas in the central and southern portions of the Off-Site Area. The barrier wall construction, because it required excavation of several hundred feet at the perimeter of the Off-Site Area, verified the landfilled nature of the area. During the Material Handling/LTTT Study, a portion of the central Off-Site Area was found to contain many deteriorated drum carcasses and parts. This area is also a significant source area on Site.

In February 1997, as part of the expedited interim remedial measures, a groundwater pump and treatment system was installed in the wetland area. The pumping system referred to as the Perimeter Groundwater Containment System (PGCS), provides containment for a groundwater plume in the northwest portion of the Site. In addition, a groundwater treatment system, including phase separation, UV/oxidation, precipitation, filtration, air stripping, and carbon adsorption, was constructed to treat groundwater from the PGCS.

In 1997, a continuous barrier wall was installed around the On-Site Containment Area, the ACS operating facility, the Off-Site Containment Area and the Kapica-Pazmey Area. The barrier wall encloses the known source areas at the Site. A groundwater extraction system inside the barrier wall, comprised of eight 100-foot long extraction trenches, was installed to maintain a hydraulic capture zone within the barrier wall, and is referred to as the Barrier Wall Extraction System (BWES). Groundwater from the BWES is also treated in the groundwater treatment system.

The PGCS has been operated since March of 1997, and the BWES was started-up in May 1997. Groundwater from these systems continues to be treated through the groundwater treatment system. Based on the performance data collected to date, these interim systems have successfully, isolated the source areas of the Site thus preventing further off-site groundwater contamination from occurring and providing active treatment of groundwater from within the barrier wall (BWES) and in the northeast portion outside the barrier wall (PGCS).

## 1.3 WASTE CHARACTERIZATION

The interim remedial measures cut off the groundwater migration pathways from the source areas and provide mass removal and treatment of contaminated groundwater. However, the soil contamination source areas have been contained but not directly treated date/. Therefore, to fully understand the conceptual design process, the source areas will be discussed here. The source areas, in general, are those areas that contain "buried waste," defined in the Statement of Work (SOW) section of the ROD as those areas of contamination with VOC concentrations greater than 10,000 mg/kg or PCBs concentrations greater than 10 mg/kg. In addition to the primary source areas, areas of "contaminated soil," defined in the SOW as concentrations in excess of clean-up goals but less than those defined as buried waste, exist near each of the source areas.

It is important to note that the SOW anticipated a remedial action involving LTTT and a residential end-use for determining the risks at the Site. However, based on results from the Materials Handling/LTTT study and the revised Baseline Risk Assessment (not yet approved by U.S. EPA), the remedial action is not expected to include LTTT. The risk calculations will be based on industrial end-use for the Site as stated by the Agency. Therefore, the clean-up goals will likely be modified from those listed in the current SOW.

To gain a better understanding of the primary source areas addressed by the conceptual design, each of the areas of concern are discussed below.

### 1.3.1 Source Areas

The primary identified source areas at the Site, presented on Figure 2, are:

1. The On-site Containment Area. According to the ROD, approximately 400 drums of unknown sludges and semi-solids were suspected to be buried in the On-site Containment Area. Subsequent geophysical surveys indicate that the On-Site Containment Area may contain between 1000 and 2500 drums.

2. The Still Bottoms Pond Area. This area includes the former Still Bottoms Pond, treatment lagoon #1, and adjacent contaminated areas of the ACS facility. The Still Bottoms Pond Area received still bottoms waste from the solvent recovery process. The pond and lagoon were drained and filled with crushed drums containing sludge materials, along with miscellaneous rubble and debris. A cross section, illustrating the contaminant concentrations by depth in the Still bottoms Pond, is shown on Figure 3.

3. Off-site Containment Area and Kapica-Pazmey Area. The ROD reported that the Off-Site Containment Area received wastes that included 20,000 to 30,000 punctured, crushed drums, general refuse, on-site incinerator ash, and a tank truck containing solidified waste paint for disposal. The Materials Handling/LTTT Study, October 1997, indicates that up to 50,000 drums, predominantly crushed and non-intact, could be buried within the Off-Site Containment Area. The area surrounding the Off-Site Containment Area, to the west and south is contiguous with the City of Griffith Landfill and contains landfilled wastes. A cross section through the Off-Site Containment Area, is shown on Figure 4. The Kapica-Pazmey property has impacted soil from direct disposal as a result of a drum washing area.

Contaminated groundwater has migrated off-site in the shallow aquifer. The areas of groundwater impact outside the barrier wall include an area to the north referred to as the North Area and an area to the south/southeast referred to as the South Area. Further discussion of these areas is presented in Section 7.

## 1.4 CHEMICALS OF CONCERN

The chemicals of concern which impact the groundwater at the Site are volatile organic compounds (VOCs) including chlorinated hydrocarbons and benzene, and some semi-volatile organic compounds (SVOCs). The interim expedited remedial measures implemented in 1996 and 1997 have contained much of the groundwater plume, and have isolated the sources of groundwater contamination from further migration. Chemicals of concern that are present in the soils and waste at the Site are primarily VOCs and PCBs, and these will be addressed in the conceptual design described herein.

### 1.4.1 Volatile Organic Compounds

To determine the areal and vertical extent of total VOC contamination, analytical results from soil samples collected during the RI and subsequent investigations were used to plot the areas shown on Figure 2. Boundaries of the VOC contamination were defined by evaluation of the sample concentrations and the sample locations. A concentration of 10,000 ppm was used to define the outer boundaries of buried waste, as defined in the ROD. Iso-concentration lines were also defined at 1,000 ppm and 100 ppm (shown on Figures 3 and 4). The majority of the VOC contamination lies within the On-Site Containment Area (associated with the drum burial), the Still Bottoms Pond Area (as a result of the solvent recovery waste disposal), and the Off-Site Containment Area (associated with the punctured drum and waste disposal).

Once the areal and vertical extents of contamination were established, the total VOC mass in each source area was estimated for use in the ISVE models and to determine at which depth a majority of the mass is located. The mass was calculated from the average VOC concentration of the soil samples within the boundary of a given area. Where concentrations were reported as ND (not detected), the concentration of the contaminant was set equal to the detection limit, to produce conservative results. The actual mass however, is unknown because the calculation is based on soil boring data. Review of the boring data shows that the soil sample concentrations vary in that there are samples of high concentration next to samples of lower concentrations. This variability indicates that there are localized areas of VOCs within areas of relatively unimpacted soil; typical of areas with buried drums, sludges and debris. Because of the variability, an accurate estimate of mass is not possible.

Details of the calculation are provided in Appendix A.

### 1.4.2 Polychlorinated Biphenyls

The source areas for PCBs are generally limited to the Still Bottoms Pond Area , the Off-Site Containment Area, and the Kapica-Pazmey Area (Figure 1). The areal and vertical extents of PCBs were determined based on the RI soil sample analytical data. The PCBs present in the Still-Bottoms Pond Area are at or near the surface and based on the revised Risk Assessment, pose an unacceptable risk to the future workers at the Site. There were also some detections of PCBs south of the Still Bottoms Pond Area, but these detections were generally at depths of between 15 and 20 feet. These PCBs do not pose an unacceptable risk because of their burial depth. As mentioned in Section 1.2, PCBs were also detected in the sediments in the wetlands west of the Site, probably due to the off-site transport of PCB-laden sediment via storm water runoff from the Site.

PCBs were also detected in the Off-Site Area, although the detections of PCBs in this area were more random than in the Still-Bottoms Pond Area, as might be expected in a landfilled area. Because of the nature of waste placement in this area, the PCB contamination is likely not contiguous throughout the area.

### 1.4.3 Inorganics

The primary areas of inorganic contamination on Site contain lead concentrations in excess of 500 ppm and are located in the Still Bottoms Pond Area, the Off-Site Containment Area, and the Kapica-Pazmey area. Detected lead concentrations in the Still Bottoms Pond Area were detected in excess of 500 ppm in two test pits and one soil boring. This area lies within the PCB-contaminated area, and will be covered. Concentrations of lead in excess of 500 ppm were detected between 3 and 10 feet in the Kapica-Pazmey area and between 10 and 15 feet in the Off-Site Containment Area, both of which will be covered. A single test pit excavated in the On-Site Containment Area contained lead in excess of 500 ppm.

## 1.5 RISK ASSESSMENT

The findings of the risk assessment, once approved by U.S. EPA, will be summarized here.

## 2.0 CONCEPTUAL REMEDIAL WORK PLAN

According to the ROD, under current-use scenarios, the primary risk of exposure from the site contamination would be through:

1. Incidental ingestion, inhalation of vapors and dermal contact with contaminated groundwater

2. Inhalation of vapors from subsurface releases and fugitive dust from surface contaminants

3. Ingestion and dermal contact of contaminated soil, and

4. Ingestion and dermal contact with contaminated media in the wetlands, surface water and sediment in the site's drainage ditches.

For future-use scenarios, risk from exposure could occur from ingestion, dermal contact and inhalation from the contamination in the groundwater, soil, vapor emissions, and surface water.

The risk scenarios are based on a residential property use at a $10^{-6}$ Target Cancer Risk and a Hazard Quotient less than 1. Remediation levels were established based on these risks and presented in the SOW. Based on the revised Baseline Risk Assessment, the residential use scenario for the Site is not appropriate, because of the industrial zoning on the property and the landfilled nature of the Off-Site Area. Treatment of the contamination at the Site to address a residential risk level would not provide benefits to the community, given that a removal action would have a much greater short-term risk without the long term benefit of significant additional risk reduction. (See Exhibit 1 Report on Short-term risk attached hereto). Therefore the original ROD remediation levels and the remedy itself need to be modified to reflect the industrial use scenario.

### 2.1 ROD REMEDY

The following major remedial action components were established in the original ROD:

1. Groundwater pumping and treatment to "dewater the site" and contain the groundwater plume;

2. Excavation and off-site incineration of the 400 drums in the On-Site Containment Area;

3. Excavation of buried waste for LTTT;

4. In-situ soil vapor extraction (ISVE) pilot study of buried wastes in the On-site Area;

5. ISVE of contaminated soils;

6. Continued evaluation and monitoring of wetlands, and if necessary, remediation;

7. Long term groundwater monitoring;

8. Fencing the Site;

9. Implementation of deed and access restrictions and deed notices; and

10. Private well sampling with possible wells closures or groundwater uses advisories.

Several of these actions have already been completed or implemented at the site:

1. Groundwater pump and treat system
6. Evaluation and monitoring of the wetlands
7. Groundwater monitoring program
8. Fencing the Site
9. Implementing deed and access restrictions and deed notices, and
10. Private well sampling program

In addition, a containment barrier wall was constructed around the Site source areas. The barrier wall contains the Site source areas and the contaminated groundwater beneath the site. One foot of clay cover has also been placed on the Off-Site Area. Other actions will be implemented as part of the proposed conceptual remedy:

2. On-Site Containment Area drum removal and off-site disposal

6. Excavation of PCB contaminated sediments in the wetlands for on-site consolidation

4., 5. In-situ soil vapor extraction

The alternate remedy is required because of the results of the 1997 Material Handling/LTTT Treatability Study, which was conducted to evaluate the technology as a remedy. The results of the study showed that even though LTTT can be effective at treating organic compounds, implementing the technology at the ACS Site would be impractical based on the following findings:

- A severe explosion hazard would exist from the excavation, handling and treatment of VOC-contaminated material. This is especially the case in the treatment system off-gas unit, where high concentrations of organic vapors could build, due to heating the soil to be treated.

- Approximately half of the contaminated material in the Off-site Containment Area contained municipal waste that was covered or commingled with soil. The amount of municipal waste was estimated to be 30 to 60 percent by weight. Since municipal waste is not amenable to LTTT, it would have to be managed separately, cleaned of the chemicals of concern, and disposed off-site. Steam cleaning, as required by the ROD, is not practical on municipal waste. Therefore, other management options for the waste would have to be investigated.

- Approximately 65 percent of the VOCs were lost as fugitive emissions during sample preparation for the treatability study, which implies that VOCs similarly will be lost as fugitive emissions during full-scale handling and blending operations. This situation would be inconsistent with controlling vapor emissions during excavation and would require an extensive engineered system in an attempt to minimize the short-term risk to the Site workers.

The LTTT study concluded that it would be necessary to develop an alternate remedy to manage the organics.. Many separate treatment technologies were evaluated in the 1992 Feasibility Study (3). Table 1 presents a screening matrix for the technologies evaluated, and shows that various technologies were screened out based on effectiveness, implementability, cost, or other criteria. As indicated in Table 1, there are a number of technologies that remain following the screening process, and the alternate remedy incorporates all of them.

Because of the Industrial/Commercial nature of the Site property, a final remedy that consists of removing principal threat by source reduction, process waste treatment and containment should be acceptable under the NCP. Therefore, the following alternate remedy has been developed for the Site.

## Table 1: Technologies Evaluated During Feasibilty Study

| Technology | Media | Reasons for Screening Out Technology | | | | | |
|---|---|---|---|---|---|---|---|
| | | Not Protective | Regulations Prohibit | Not Reducing TMV | Questionable Effectiveness | Cost Prohibitive | Difficult to Implement |
| Ex-Situ Bio Treatment | G | | | | | | |
| Chem. Precip. | G | | | | | | |
| UV/OX | G | | | | | | |
| Air Stripping | G | | | | | | |
| Ex-Situ Steam Stripping | G | | | | | X | X |
| GAC Adsorption | G | | | | | | |
| Ion Exchange | G | | | | | X | |
| POTW Treatment | G | | X | | | | |
| In-Situ Steam Stripping | G | | | | | | X |
| | BW | | | | | | X |
| | SS | | | | | | X |
| In-Situ Bio Treatment | G | | | | | | |
| | BW | | | | X | | X |
| | SS | | | | X | | X |
| Ex-Situ Bioreactor / Landfarming | BW | X | | | X | X | X |
| | SS | | | | | X | X |
| Off-Site Incineration | BW | X | | | | | |
| | SS | | | | | X | X |
| On-Site Incineration | BW | | X | | | | |
| | SS | | X | | | | |
| Off-Site LTTT | BW | X | | | | X | X |
| | SS | | | | | X | X |
| On-Site LTTT | BW | | | | | X | X |
| | SS | | | | | X | X |
| In-Situ Vitrification | BW | X | | | X | X | X |
| | SS | | | | X | X | X |
| Ex-Situ SVE | BW | X | | | | X | X |
| | SS | X | | | | X | X |
| In-Situ SVE | BW | | | | | | |
| | SS | | | | | | |
| Ex-Situ Solvent Extraction | SS | | | | X | X | X |
| In-Situ Fixation | SS | | | | X | | |
| In-Situ Radio Frequency | SS | | | | X | | X |

G = Groundwater BW = Buried Waste SS = Soil and Sediment

## 2.2 ALTERNATE REMEDY

The remedial action objectives established in the ROD for the Site are:

1. Minimize exposure to contaminated soil, groundwater, buried drums/liquid wastes/sludges or other substances which would result in a risk greater than the acceptable risk range identified in the ROD;

2. Restore groundwater to applicable state and federal requirements;

3. Reduce migration of contaminants off-site through water, soil or other media, and

4. Reduce the potential for erosion and possible migration of contaminants via site surface water and sediments.

To achieve these objectives, under the Alternate Remedy, the items listed in the ROD remedy would be implemented, except for LTTT of the contaminated wastes and soils. The risks posed by the contaminants at the Site will be addressed as follows:

1. Incidental ingestion, inhalation of vapors and dermal contact with contaminated groundwater will be prevented through containing the groundwater with the existing barrier wall, covering the Site, containment of groundwater plume, and groundwater pumping and treatment to remove contaminants.

2. Inhalation of vapors from subsurface releases and fugitive dust from surface contaminants will be prevented by covering the source areas and treating subsurface contaminants with ISVE.

3. Ingestion and dermal contact with contaminated soil will be prevented by covering the Site source areas.

4. Ingestion and dermal contact with contaminated media in the wetlands, surface water and sediment in the site's drainage ditches will be prevented by covering the source areas and excavating the contaminated sediments in the wetlands.

The Alternate Remedy has the following elements: 1) source (mass) reduction, 2) treatment of process wastes, and 3) containment of wastes. These elements will serve to eliminate contaminant migration from source areas and reduce potential human exposure to acceptable levels. The proposed Alternate Remedy consists of:

- ISVE in the Still Bottoms Pond Area *(source reduction and prevention of vapor migration)*,

- ISVE in the areas of VOC impact in the Off-Site Containment Area *(source reduction and prevention of vapor migration)*,

- Treatment of extracted vapor *(vapor control)*,

Installation of an engineered cover over the areas containing buried waste *(containment and prevention of direct contact with impacted soil and vapors).*

In addition, the expedited remedial actions that currently contain the source areas and groundwater, including the PGCS, BWES, and barrier wall, will continue to operate as part of the proposed alternate conceptual remedy. The following items will be conducted or continued in accordance with the ROD:

- Excavation and consolidation inside the barrier wall of the PCB contaminated sediments from the wetland area,

- Removal and off-site disposal of the intact drums in On-site Containment Area,

- Continued groundwater pumping from the PGCS and BWES and treatment through the groundwater treatment plant in accordance with the performance standard verification plan (PSVP) for the groundwater treatment system,

- Long term groundwater monitoring, in accordance with the Agency-approved groundwater monitoring program, and

- Private well sampling, in accordance with the Agency-approved groundwater monitoring program.

The proposed Remedial Components are shown on Figure 1. The remainder of this document presents descriptions of the individual components for the proposed alternate conceptual remedy.

# 3.0 IN-SITU SOIL VAPOR EXTRACTION

In-situ soil vapor extraction (ISVE) technology is a physical mechanism designed to remove VOC compounds from contaminated subsurface media. ISVE is operated by applying a vacuum-induced air flow through the subsurface, to remove the vapors in the pore space. The initial mass removal is through advective flow regime, in which the vapors present in the pore space of the soil are removed. Once the initial soil vapors are removed, ISVE is limited by the rate at which VOCs, absorbed on the soil particles, trapped in the pore space as liquid, and dissolved in the pore water, partition (volatilize and diffuse) into the pore space. This is referred to as diffusive flow regime.

Because the barrier wall already contains the source areas at the Site, the main objective of ISVE at the ACS Site is mass reduction in these source areas by extracting mobile VOC contaminants from below the ground surface. The source's mass reduction will be from preferential air and water flow pathways, where contaminants, if their physical and chemical characteristics are such that they are mobile, will migrate. Certain compounds such as VOCs have characteristics that make them mobile. Other compounds, such as semi-VOCs, have characteristics that typically make them less mobile or immobile. Mobile-characteristic contaminants, which are not within these preferential flow pathways, will not likely migrate because they are trapped within the soil/debris/drum matrix. If they do migrate, they will migrate to preferential pathway and will be removed through the ISVE (if in vapor form or product form) or groundwater extraction system (if dissolved in water or in product form). Either way, the mobile contaminants are still within the containment area. Immobile contaminants in the containment area are not a priority because they will not mobilize from the source areas through the preferential flow pathways and are therefore contained.

Applying ISVE to the source areas will decrease the mobile mass of contaminants so that they cannot migrate to groundwater within the barrier wall. This reduction, in conjunction with the barrier wall and groundwater pump and treat system, will further reduce the potential for off-site migration. In addition, ISVE will reduce the opportunity for vapor contact through the ground surface by reducing the vapors in the subsurface and minimize the VOC loading in the treatment plant by removing VOCs before they dissolve into the groundwater. This remedial component is consistent with the objectives of the final remedy for the ACS Site, as defined in the ROD, to address principle threat by reducing the risk of exposure to contaminated vapors and reducing the potential migration of mobile contaminants to the groundwater.

### 3.1 AREAS TO BE TREATED WITH ISVE

As discussed in Section 1.3, the areas containing high VOC concentrations are found in four primary areas:

- On-site Containment Area
- Still Bottoms Pond Area
- Off-site Containment Area
- Kapica-Pazmey Area

In the On-Site Containment Area, the elevated levels of VOCs are coincident with the buried drums. These drums, based on test pitting during the RI and observation during the recent construction in this area, are generally intact and are stacked on their sides, three high. Although the number of drums is likely higher than the ROD estimate, drums within the defined On-Site Containment Area can be removed in accordance with the ROD. The intact drums will be sent off-site for incineration or disposal, depending on the contents, in accordance with all local, state, and federal regulations. Section 6 discusses the drum removal in greater detail.

For the other three areas of elevated VOC contamination, the percentage of total VOC mass present was determined (see Section 1.3 and Appendix A). The percentages of total VOC mass by area are as follows:

| Area | Distribution of Estimated VOC Mass within Containment Area | Percentage of Area Soil Mass that is Impacted with VOCs |
|---|---|---|
| Still Bottoms Pond | 65% | 1.6% |
| Off-Site Containment | 32% | 1.1% |
| Kapica-Pazmey | 3% | 0.3% |

As shown in the above table, the mass of VOC-contaminated soils within the Kapica-Pazmey Area before the barrier wall was installed represented only 3% of the total VOC contaminant mass within the soil. Because a portion of this VOC-impacted area was along the barrier wall alignment, some of the mass was removed during installation of the barrier wall. Therefore the mass in the Kapica-Pazmey area now represents less than 3% of the total VOC mass within the barrier wall and only 0.3% of the Kapica-Pazmey soil mass is impacted. ISVE will not be implemented as part of the conceptual remedy for the Kapica-Pazmey Area.

No.

## 3.2 ISVE MODELING

Following determination of the contaminant mass present in each area, the Still Bottoms Pond Area and the Off-Site Containment Areas were modeled for application of ISVE. The purpose of the ISVE modeling was: 1) to determine if ISVE was a feasible remedy, and 2) to develop preliminary design criteria. Two screening models, which are recommended by the EPA, were used.

The screening models are Hyperventilate® and BioSVE®. Both models use simple mass transfer and partitioning equations such as the ideal gas law. These models estimate mass removal under "ideal" conditions, which predict fairly accurate mass removal at initial startup of the ISVE system, during advective flow. The mass removal during diffusive flow is not predictable from the models, as the mass removals will decrease over time. However, understanding this, the models are a useful tool to estimate the feasibility of ISVE for application at a site. The models also provide preliminary estimates of mass removal, desired removal rates, achievable flowrates, and other preliminary design parameters.

The two models were used to answer two different questions regarding the conceptual design of the ISVE system. Hyperventilate answers questions related to the ISVE system design. For instance, What radius of influence (ROI) can be expected? How many wells does the system require? What flow rate is needed per well? What are the initial vapor concentrations? BioSVE then answers the question: How much removal can be expected with the system?

The initial model used, Hyperventilate®, was used to estimate feasible flow rates, initial vapor concentrations, and desired and feasible mass removal rates. Then, once these variables were estimated, the output from Hyperventilate® was used in the second model, BioSVE®, to estimate a rate of removal over the operational life of the ISVE system, based on individual contaminants that make up the estimated mass of VOCs. The input parameters and output of the models and a discussion of how the parameters are defined are provided in Appendix B. A summary of the input and output parameters is presented on Table 1 in Appendix B. The conceptual design of the ISVE system for the ACS NPL Site was developed from the results of the modeling effort.

The model outputs typically represent ideal and initial conditions such as those that will likely be observed within the first few weeks of start-up. The model output values represent maximum design criteria under ideal conditions therefore, the models were used to only address the feasibility of ISVE as part of the alternate remedy. Under actual operating conditions, especially during steady state removal or the diffusive flow regime, concentrations and flowrates are expected to be significantly reduced. For example, the mass removal rates are expected to decrease within the first several months as the accumulated vapor that is accessible to the vacuum is extracted. Often, ISVE systems are designed based on the model's ideal and start-up conditions, which leads to an over-designed system that allows for no flexibility as vapor concentrations decline. Also, in many cases once the vapor has declined, the operation is assumed to be completed. The system for this site has been designed to address the decline in vapor rates to prevent an oversized, inflexible system and a logical approach to develop shut-off criteria to address rebound effects is discussed further in Section 3.7 Phased Start-up.

## 3.3 PRELIMINARY DESIGN CONSIDERATIONS

Preliminary design of the ISVE system included consideration of the challenges previously identified in meetings and conversations with U.S. EPA and IDEM personnel. These challenges included uncertainties regarding effectiveness of ISVE around buried debris and garbage in heterogeneous landfills, free product recovery, and "short circuiting" of air flow. Specific design features related to each of these issues are summarized in the following paragraphs.

### 3.3.1 ISVE Effectiveness Around Buried Debris and Waste

The subsurface at the Site includes buried debris, municipal waste, and other objects that introduce pockets of air into the subsurface due to imperfect packing of soil. These pockets would represent channels for preferential flow in the subsurface and could potentially dominate the vapor flow pattern induced by the applied vacuum in the ISVE system. For this reason, the ISVE system has not been designed to induce uniform vapor flow through the subsurface, but rather to prioritize recovery of the contaminants in certain areas depending on the potential for those contaminant areas to impact groundwater and soil within the barrier wall in the future. This natural prioritization of contaminant recovery (or preferential recovery) will first remove the contaminants that have the greatest potential for future migration.

Preferential recovery occurs because contaminants are recovered first from the zones of highest vapor flow during ISVE, which is also expected to be the zone of highest contaminant distribution. The concentration of contaminants is likely greatest in the voids caused by heterogeneities, such as collapsed drums and garbage, because these zones offer the least resistance to gravity-driven migration. These are the same zones in which preferential flow will occur during ISVE. Therefore, preferential flow in these zones during ISVE will actually optimize initial recovery of contaminants and will provide early removal of contaminants from these pockets of highest concentration. The ISVE system will include valves on individual wells, allowing each well to be used either as a vacuum extraction point or as a passive air vent to influence the pathways as necessary.

### 3.3.2 Free Phase Product

Free phase product is a priority for removal from the Site because free phase product has the highest potential to impact soil or groundwater in the future. Although small amounts of free phase product have been observed at the Site during previous investigations, there do not appear to be large volumes of free phase product at the Site. A sheen has been detected in selected wells, but measurable thicknesses of free product have not been detected in any well. The presence of a sheen in selected wells suggests that free product, where present, exists only at low volumes that are immobilized in soil above the water table. Highly concentrated areas of free phase product do not appear to be present because such areas would likely cause significant downward migration of free product that would be detectable as measurable thicknesses in groundwater monitoring wells.

Since free product only exists at low volumes where it is found on Site, ISVE is an appropriate technology to maximize recovery. ISVE provides recovery of volatilized constituents via a vacuum-induced vapor flow through the vadose zone between the ground surface and water table and through the dewatered zone. ISVE uses the same above ground equipment and recovery mechanisms as bioslurping, which is often mentioned specifically as a free product recovery technology. As ISVE is operated, vapor will preferentially flow through the zones with the greatest proportion of void spaces, which may be caused by debris or garbage. These zones of preferential flow are likely to also be the greatest areas of accumulation of free product since free product will similarly migrate according to lines of least resistance. Therefore, the volatile compounds at the Site are expected to volatilize relatively quickly into the flowing vapor stream and recovery of free product will be natoptimized.

### 3.3.3 Smearing

If free phase product is present in the soils floating atop the water table, the potential exists for "smearing" this product across the soil matrix. Smearing occurs when a pool of free phase product is mobilized through the soil and leaves residual product in its path. This "smear zone" will greatly increase the surface area of free phase product that will be contacted by vapor recovered via the ISVE system. During vapor extraction, free phase product is recovered by direct diffusion into the vapor. Since diffusion is proportional to the surface area of contact between vapor and the contaminants, increasing the surface area will directly increase the rate of recovery of the contaminants. Therefore, by "smearing" this product, if present, across the soil matrix (thereby increasing the surface area of the contaminants), the effectiveness of the ISVE system on these contaminants will be increased.

### 3.3.4 Short Circuiting

Short circuiting occurs when a source of atmospheric air is introduced to the subsurface in which the ISVE system is operating and causes this air to be preferentially extracted instead of the contaminated soil vapors. Short circuiting is a concern at any site for which ISVE is considered because short circuiting can causes preferential flow of uncontaminated air through the system, and thereby reducing the achievable radius of influence. The most common cause of short circuiting is direct flow of air from above ground into the extraction well because the ground surface is not sealed. This potential for short circuiting will be minimized at the site because the entire ground surface over the ISVE system will be sealed with an engineered cover at a minimum. The ISVE system, moreover, is designed to address a small amount of short circuiting given that individual wells can be adjusted to reduce or increase flow and vacuum or opened to introduce air into the system at preferential points, thereby redirecting the preferential flow paths that the atmospheric air follows.

## 3.4 DESIGN

The conceptual ISVE design takes into account the concerns with ISVE in waste, short circuiting and free product, as well as the results of the modeling and other institutional knowledge about the Site and ISVE. The major components of the ISVE system consist of:

- Extraction wells and piping
- Vacuum blower system
- Condensate removal system
- Extracted vapor treatment system

### 3.4.1 Extraction Wells and Piping

The extraction wells will be installed so that the screened portion of the well is within the source area. The screens will be deep enough to avoid short circuiting of atmospheric air through the ground surface. The well diameters will be four inches, which is typical of ISVE systems. Smaller diameter wells might lead to higher vacuums and subsequent mounding of groundwater and larger wells typically do not significantly increase treatment efficiency.

The ROI for the individual ISVE wells has been estimated to be 30 feet, based on hydraulic conductivity of undisturbed soil from data obtained during the RI. The 60-foot spacing is a conservative estimate that coincides with ISVE systems in similar geologic settings. Conservative spacing may be greater, especially given the void space through debris and the results of modeling described previously. For example, the actual ROI may be greater in the Off-Site Containment Area where varying amounts of debris are present in the subsurface. Montgomery Watson calculated that 46 extraction wells are needed in the Still Bottoms Area and 30 wells are needed in the Off-site Containment Area based on the areal extent of impacted soil. To provide adequate coverage, the wells will be placed so that there is overlap of the ROI. Within the Still Bottoms Area, the ISVE well locations may need to be field-adjusted to avoid site structures and avoid interfering with the ACS facility operations. Conceptual layouts of the Off-Site Containment Area and Still Bottoms Pond Area ISVE well fields are presented on Figures 5 and 6, respectively.

The well heads will be below grade in shallow utility vaults, but accessible for vacuum and water level measurements and vapor sample collection, if needed. Each well head will consist of a removable cover, throttling valve, sample and monitoring port, and lateral conveyance line. Ports will be installed on the lateral line to measure vacuum and collect vapor samples. A typical well design is shown on Figure 7.

The conveyance piping plan will involve laying pipe on the existing grade or slightly below grade, to minimize trenching and the handling of contaminated materials necessitated by trenching. The initial and permanent covers will be placed over the pipes to protect from traffic and weather damage. Because the cover thickness will be less than 4 feet, the pipes will be insulated at low points, where condensate may accumulate to provide additional freeze protection. The conveyance piping of the ACS ISVE System will be designed so that series of wells in the well field are joined to a common header. Wells located within specific areas will be connected as a section to a header with lateral lines. The header pipes will be connected to one common header at the blower. The header sections will have valves at the common header pipe to perform fine vacuum and flow adjustment. Each individual well will have a valve at the well head for coarse vacuum and flow adjustment and to allow air venting during system operation. The piping configuration is presented in Figure 6.

The Off-Site Containment Area will have five well sections in the well field.. The well sections will correspond to specific areas within the Off-site Containment Area, but because of the topography of the site, the header placement for each well section will be located through the center of the area to minimize the need for trenching. The Off-Site Containment Area is mounded, with the highest elevation near the center of the impacted area. The headers are designed to slope outward towards the edge of the impacted area (and toe of the cover) to reduce condensate accumulation in the headers.

### 3.4.2 Vacuum Blower System

The ISVE blower system will be housed in a small building on or near the well field. The system blowers will be sized based on the estimated flowrate and vacuum requirements. It is anticipated a centrifugal blower will be used. Process controls will be minimal. There will be safety controls to shut-off the blower if it overheats or becomes flooded with water. Included with the major equipment components will be flow meters, blower silencer, vacuum and pressure gauges and valves. The basic equipment components are presented in Figure 8, Conceptual Process Flow.

### 3.4.3 Condensate Removal System

Initially, condensate will be generated in the ISVE system because the soil vapor will likely be saturated or nearly saturated with groundwater vapor. As the Site is dewatered and the subsurface moisture is removed, the water saturation of the vapor will drop, however, some condensate will still be generated The condensate will be minimized through operation of the system and to minimize accumulation. Operating the system at low vacuums will minimize the condensate, which can be reduced further, either in the field or collected and removed at the blower inlet. Condensate can be removed in the field by sloping the conveyance piping toward the wells, installing filter fabric in the wells, driplegs in the well field or a combination of these or other components.

?

why? will contain VOCs.

At the blower, the system will include a "knockout" tank with a demister. Condensate removed from the system will be treated in the groundwater treatment system. A condensate transfer pump will pump the condensate to a storage tank or the groundwater influent equalization tank in the Groundwater Treatment Plant. An alarm level will shut the ISVE system down to prevent water from flooding the blower.

## 3.5 EXTRACTED VAPOR TREATMENT SYSTEM

It is anticipated that, initially, the vapors extracted from the system will require treatment prior to being released to the atmosphere. Initial vapor mass flowrates from the wells during start-up are estimated to be greater then the allowable air emission of VOCs. The initial vapor will likely be treated with either a thermal or catalytic oxidizer. Because of the chlorinated compounds in the inlet vapor stream, a scrubber will be required to remove hydrochloric acid that is generated during oxidation of chlorinated compounds. all the time

$H_2SO_4$ " " sulfur "

Typically, this initial vapor treatment is required until vapor removal rates decrease after the initial pore vapor has been removed. At that point, the vapor concentrations in the ISVE system will be lower than concentrations at start-up and will be limited by the contaminant diffusion rates. For the ACS Site's ISVE system, the mass removal rates at start-up estimated for a single well will likely exceed the treatment capacity of the oxidizer, therefore it is anticipated that only a few wells in each area will be operated at start-up until the rates decline. Vapor treatment with regard to start-up and initial extracted vapor treatment are discussed further in Section 3.7 Phased Start-up.

A less aggressive vapor treatment system will be used after the vapor concentration decreases below a point at which it is no longer cost effective to treat the extracted vapors with a oxidizer. Depending on the vapor composition, vapor phase carbon may be a viable option. A condenser or chiller/dryer may be considered in conjunction with the carbon, to reduce the carbon usage. At some point, when the vapor concentration and mass discharge drops below the regulatory requirement, direct discharge may be possible. No. Criteria for these modifications will be detailed in the Final Design. An air permit or notification will be required because of the initial concentrations. The permit will specify the applicable regulatory requirements.

## 3.6 COMPLIANCE AND PERFORMANCE MONITORING

Compliance monitoring will consist of monitoring to comply with air emission regulations.

Performance monitoring will be conducted to evaluate and optimize the ISVE system. Performance monitoring will consist of sampling and analyzing the inlet and outlet vapor of the extracted vapor treatment system and the incoming combined vapor from the well field, and measuring vacuums, flowrates, and temperatures. Mass removal rates will be calculated and evaluated to access the system performance and mass reduction over time. Vapors from the wells or well sections will be sampled and analyzed and water levels will be measured periodically.

### 3.7 PHASED START-UP

ISVE will be implemented first at the Off-Site Containment Area because the vadose zone is sufficiently thick at this location to allow effective operation before dewatering is completed. Therefore, ISVE can be implemented in this area before the water elevation is dropped to the target long-term level by the dewatering effort. After the water elevation in Off-Site Containment Area is dropped to the target level, the dewatering effort for the Still Bottoms Pond Area will be implemented. An ISVE system will not be installed at the Still-Bottoms Pond Area until dewatering has sufficiently lowered the water level, because the shallow depth of groundwater in this area would limit the system effectiveness.

Start-up of the ISVE systems at both the Off-Site Containment Area and Still-Bottoms Pond Area will be conducted in phases because of the uncertainties regarding subsurface conditions and nature of the ISVE mass transfer process. All the wells and piping will be installed as shown on the design drawings and the phases will be conducted using the full-scale well field. The overall concept of the phased start-up is to initially start operation with a subset of extraction wells, observe performance over an initial period, and use the initial results to adjust the design of the full-scale mechanical and vapor treatment system. This will allow flexibility to adjust system operation and design of subsequent phases to optimize overall operation when operating conditions reach steady state or the diffusive regime. It will also provide a better understanding of local conditions around each well. Specific features that will be provided by the phased implementation schedule include the following:

- Effective initial operation for uncertain site conditions.
- Capability to change operating configurations to deal with differences in localized conditions.
- Flexibility to modify system operation as conditions change over time (i.e., from advective to diffusive removal).
- Avoidance of treatment capacity exceedances.
- Optimization of energy efficiency by avoiding oversizing the system based on initial conditions and minimize pollution due to unnecessary burning of supplemental fuel. right

The phased start-up will be conducted in lieu of a small-scale pilot study. Information obtained from this start-up sequencing will be more comprehensive than a small-scale pilot test, because it will be utilizing the full-scale well configuration, will have a longer duration, and will cover a wider area. It will also be more cost-effective because the equipment sizing will be based on long-term operation during diffusive extraction, instead of short-term start-operation.

It is anticipated that the start-up will be operated in three phases:

1) day one to month six "pilot phase"
2) month 6 to month 12, "design and installation phase"
3) month 12 to month 18 "optimization phase."

After start-up, long-term operation and maintenance will begin.

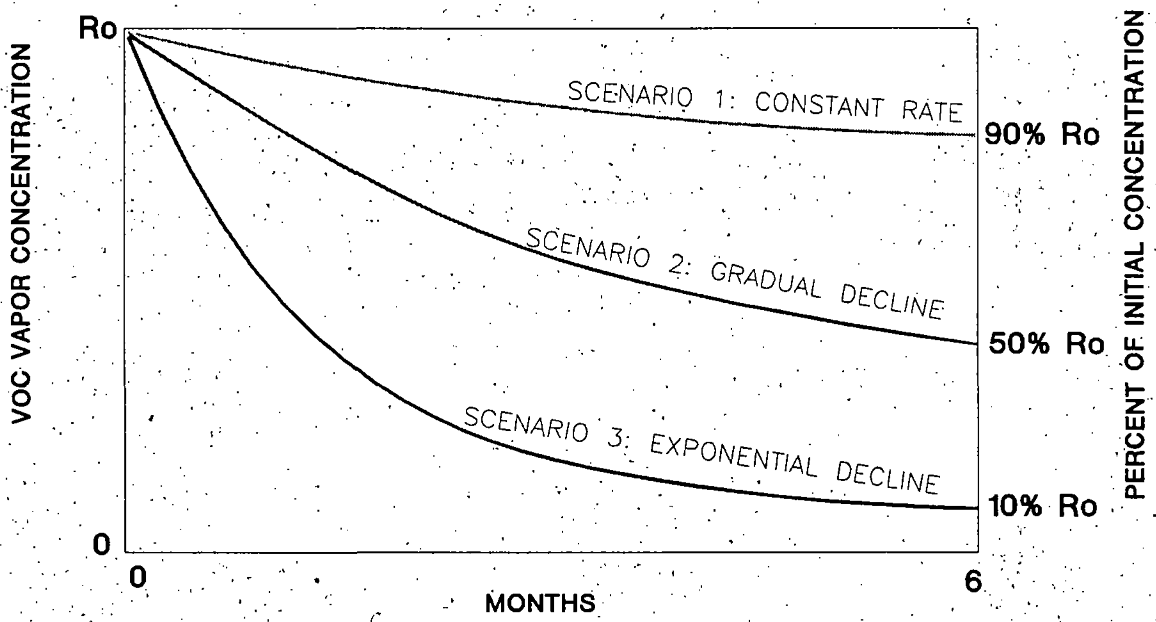
The first phase of ISVE in the Off-Site Containment Area will involve applying a vacuum to approximately eight wells, at the locations shown on Figure 7. These wells have been selected to provide a distribution throughout the designated areal extent of contamination. Initially, the applied vacuum will be provided by a blower capable of providing up to 500 scfm flow at a maximum vacuum of 60 inches $H_2O$. It is expected that the actual applied vacuum will be significantly less, to limit preferential flow as much as possible. A 500 cfm thermal oxidizer with heat exchanger will be initially used to provide extracted vapor treatment with a maximum destruction capacity of 1,700 pounds per day. This 500 cfm system is referred to as a "pilot system".

Because of the initial high vapor concentrations, it is likely that early operation will be limited by the destruction capacity of the thermal oxidizer. It is estimated that the initial achievable removal rate from each may be as high as 1,000 to 2,970 pounds per day. Therefore, all eight wells may not be operated simultaneously during pilot phase operation. The wells will be alternated initially to evaluate differences in characteristics from each well.

Once the characteristics are determined, wells with low and high VOC vapor concentrations can be operated simultaneously to prevent exceeding the treatment capacity of the thermal oxidizer, while maximizing its volumetric capacity. The number of wells operating at any one time will be gradually increased to maintain maximum destruction of hydrocarbons in the thermal oxidizer. The "pilot phase" of ISVE will be operated for up to six months.

VOC concentrations in the extracted soil vapor will decline over time because of the nature of the soil vapor extraction process and the mass transfer phenomenon. The decline may be approximated by one of the three characteristic patterns shown in the figure below.

CHARACTERISTIC PATTERNS OF VAPOR CONCENTRATION DECLINE




Concentrations may drop gradually in a nearly straight line as shown in Scenario 1, moderately as shown in Scenario 2, or exponentially and sharply as shown in Scenario 3. The design of the full-size system and phased integration of additional extraction wells will be dependent on the actual characteristic decline in concentrations that are observed during the pilot phase. The implementation schedule for the next two phases is explained for each of the different scenarios in the following paragraphs.

### 3.7.1 Scenario 1 – Gradual Decline

Under Scenario 1, concentrations will decline gradually and the trend of concentrations over the initial six months will approximate a straight line. This scenario represent a condition in which the extracted vapor is from a significant source such as a trapped pool of free phase product in void spaces. Typically, vapor concentrations for this scenario would remain relatively high and initial operation of the system would be limited by the destruction capacity of the thermal oxidizer. Depending on the vapor treatment capacity limit, it is possible that a subset of the eight extraction wells shown on Figure 7 would be utilized for the first six months. Following the pilot phase, a larger system will be designed, procured, and installed during the design and installation phase (month 6 through month 12). During this time, additional wells will continue to be brought on-line, if additional destruction capacity available in the vapor treatment unit. The larger system will be started up at month 12 and used in conjunction with the initial 500 cfm system for the next 6 month phase (optimization phase). During this time, the overall system will continue to be optimized and the initial system will be modified to treat the measured flow.

### 3.7.2 Scenario 2 – Moderate Decline

Under Scenario 2, concentrations would decline moderately and after six months, might be as low as 50% of the initial values. In this scenario, accessible subsurface contamination would be removed at a proportionally high rate, but the rate would reach an asymptotic limit. The decline in concentrations over six months is expected to be sufficient enough that all eight initial wells could be operated simultaneously by the end of the pilot phase (six months). While the full-size system is designed and installed during months 6 through 12, additional wells would be brought on-line, as needed, to maintain maximum destruction capacity in the thermal oxidizer. The final system would be started up at month 12 and used in conjunction with the initial 500 cfm system. As concentrations continue to decrease, the overall system would be optimized and the 500 cfm system would be modified to treat the increased flow.

### 3.7.3 Scenario 3 – Exponential Decline

Under Scenario 3, concentrations would decline exponentially so the concentration at the end of month six would be significantly lower than the first day of operation. This pattern would suggest that the accessible zones of high concentrations were relatively small and were quickly removed. An asymptotic level would be reached relatively quickly representing long-term removal of VOCs from the subsurface. If an asymptotic level is attained within the first six months, the design and installation of the full-size system would be expedited and completed by month 12. As the full-scale system is designed and installed, additional wells would be added, as appropriate, to maximize operation of the extraction and treatment system. It is possible that destruction of hydrocarbons for this scenario would be limited by the flow-through capacity (retention time) of the oxidizer and not the destruction capacity. In this case, the full-scale system could incorporate a catalyst that would be more cost-effective for lower concentrations. For this scenario, the full-scale system would be implemented as soon as it was ready for operation. It is anticipated that the system would be on-line and optimized before 18 months had elapsed from initial start-up.

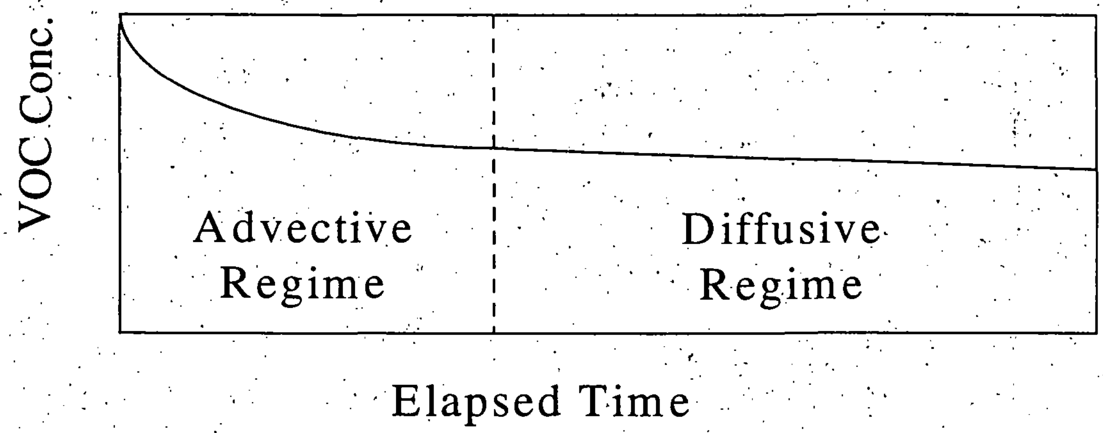
✓ Regardless of the characteristic decline scenario of VOC concentrations, the full-size system would be started up at the latest, by month 12 and would be optimized and fully operational by month 18. After month 18, the system would be operated according to a long-term operation and maintenance schedule that provides required servicing of equipment, change-outs, and periodic adjustments. The locations of the 30 proposed extraction wells and configuration of the full-size extraction system are shown on Figure 5. This system will provide complete coverage of the estimated extent of VOC concentrations greater than 100 mg/L. At the end of 18 months (maximum), extraction and treatment of soil vapor from the Off-Site Containment Area would be conducted using one system.

mg/kg

✓ The ISVE system for the Still Bottoms Pond Area will be implemented in phases similar to the Off-Site Containment Area, after the first ISVE system is fully operational. The first phase will use up to 10 wells as shown in Figure 6. This pattern of extraction wells would provide information on achievable recovery rates from across the impacted area, as well as other design parameters. The initial system will be operated for up to six months, a full-size system will be designed from month 6 to 12, and the full-size system will be implemented and optimized from month 12 to 18. The full-size system is expected to require approximately 46 extraction wells, as shown on Figure 6, which will provide recovery of VOCs above concentrations of 100 mg/L. where - initial soil levels?

## 3.8 LONG-TERM OPERATION AND SHUTDOWN CRITERIA

The ISVE systems will be operated until the primary remedial objective is satisfied, which is removal of mobile volume of VOCs from the two source areas with the greatest potential to impact soil and groundwater in the future. The two systems will be operated in different modes to maximize efficiency of recovery for the two characteristic contaminant transport regimes. These transport regimes are advective recovery and diffusive recovery. A summary of the transport regimes and graph of characteristic concentrations during each regime is provided in the figure below.




Long-term operation and shutdown criteria have been developed based on the physical processes of contaminant recovery that are part of the operation of an ISVE system. The ultimate performance of the ISVE system is difficult to predict because of the uncertainty and variability of the subsurface conditions. Consequently, the numerical parameters for shutdown will be difficult to define. However, the dominant recovery mechanisms, advective transport (Stage 1) and diffusive transport (Stage 2), are understood and shutdown criteria are typically developed based on knowledge of these mechanisms. Shutdown criteria will be defined for the two stages of recovery.

### 3.8.1 Stage 1 – Advective Transport Regime

During this stage, the ISVE system will operate continuously and will be optimized to maintain the highest level of vapor concentrations possible. The constituents removed will include contaminants in the most permeable zones and contaminants that have the greatest potential to migrate from the source area due to their mobility. The advective recovery of contaminants will be characterized by high initial recovery rates, which will decline over time as the most mobile contaminants are recovered and contaminants accessible for advective flow are depleted. While advective transport is significant, the achievable recovery of contamination will be dependent on the total vapor flow rate that can be sustained. Thus, continuously operating the ISVE system to maximize efficiency is critical to optimizing contaminant recovery during advective flow.

During the first mode of recovery, the advective recovery regime, the ISVE systems will be continuously operated during advective recovery until the VOC concentrations reach an asymptotic level. The asymptotic level will be determined by periodically recording the VOC concentration in recovered vapor and identifying when the change in concentration over time has become negligible. Mathematically, the asymptotic level will be reached if the slope of concentration change versus time is nearly zero as defined by equation (1):

$$-5\ \% < \text{slope} < 0 \qquad (1)$$

The slope of concentration change over time will be obtained by plotting the trend of VOC concentration over time, curve-fitting the data, and identifying the slope of the curve midway between the two most recent data points. If the slope is determined to be asymptotic, the ISVE system will be temporarily turned off and cyclical operation will commence in accordance with the criteria for diffusive recovery.

Continuous operation (Stage 1) will be concluded once advective recovery of contamination becomes negligible. The ISVE system will be operated for a period of time to allow optimization of the equipment and full development of the vacuum field across the entire area of concern. After this period of operation, the magnitude of advective recovery will be determined by monitoring the recovery rate of contamination and identifying the time at which the recovery rate has reached an asymptotic level. The system would be shutdown after a relatively-steady rate of recovery is observed; at such time, the ISVE system would be operated in a cyclical mode (Stage 2), with the duration of the advective stage depending on the level of soil vapor concentrations and the quantity and mobility of contaminants.

### 3.8.2 Stage 2 – Diffusive Transport Regime

During this stage, vapor concentrations and mass removal are limited by diffusion rates. Diffusive transport will remain relatively constant as ISVE operation continues, because diffusive recovery of contaminants will involve the slow diffusion from less accessible areas. The rate of diffusion will be dependent on the concentration gradient between the permeable zones accessed by soil vapor extraction and pockets of contamination in less accessible areas. Therefore, the key to maintaining recovery during the diffusive stage will be to maintain sufficient operation of the ISVE system such that concentrations in the vapor flow remain relatively low, providing a concentration gradient between the less accessible areas and more permeable zones. The ISVE system will be operated cyclically during the diffusive stage. The cycle frequency will maintain a consistent concentration gradient while decreasing the total volume of vapor that requires treatment, optimize the efficiency of vapor treatment by maintaining the concentrations in vapor recovered during times of, and minimize short-circuiting that develops during continuous ISVE operation.

To optimize the mass reduction, the system will be operated in cycles by alternately operating well sections to allow vapor equilibrium in the soil gas to be achieved at the wells that are shut off. The timing of the ISVE system on/off cycles will be determined by monitoring the concentration in recovered vapor. The purpose of the cycles will be to start the system when vapor concentrations are several orders of magnitude higher than at the time of the last shut-off period. The first off-cycle will last for three months, and then the system will be operated until asymptotic concentrations are attained in accordance with equation (1) again. Once asymptotic levels are attained, the system will again be turned off. The duration of each off-cycle will be the same as the previous off-cycle, unless the preceding period of operation was less than half the off cycle, in which case the off-cycle will be doubled. In summary, each on-cycle will last until asymptotic levels are attained and each off-cycle will last the same or double the previous off-cycle, depending on the length of the preceding on-cycle. The frequency of cycles will be systematically adjusted throughout operation to maximize the efficiency of mass removal.

No. Pulsing of the ISVE system will be stopped when operating cycles are less than 10 percent the duration of off cycles. Pulsing the system until short periods of operation are attained will provide recovery of significant contamination that has diffused from low permeability zones. Once these short periods of operations are reached, the ISVE system will no longer be technically or cost effective and shutdown will be appropriate. Therefore, this criteria dictates ultimate shutdown once the ISVE effectiveness has declined.

At the time of final shut-down, the groundwater will be allowed to recharge to the barrier wall maintenance level. The ISVE extraction wells will be opened and allowed to vent to atmosphere as a passive system.

SVOCs + DNAPL not addressed.

air injection necessary

# 4.0 DEWATERING

In accordance with the SOW in the ROD, one remedial component is to contain and treat the groundwater plume. The barrier wall contains the plume near the source areas and the existing groundwater pumping system removes impacted groundwater contained within the wall to treat that water and maintain the water levels within the barrier wall.

Lowering the water table will expose portions of the soil contamination that is currently below the water table. Once the zone of contamination is exposed, the ISVE system will withdraw contaminated vapors from the subsurface for treatment. Exposing the soil will increase the effectiveness of ISVE in both the Still Bottoms Pond Area and the Off-Site Containment Area by exposing the areas with the largest volumes of contaminants. Therefore, a critical component of the final remedy will be the dewatering program for the Site.

The water table in the Off-Site Containment Area, in the proposed ISVE system location, is currently approximately 8 to 10 feet below the ground surface (bgs). This vadose zone (area between the water table and the ground surface) thickness is sufficient to begin ISVE in this area. However, a majority of the contaminant mass in this area extends to a depth of 15 to 17 feet bgs. Therefore, to expose the largest areas of contaminant mass and to optimize the performance of the ISVE system, the water table in the Off-Site Containment Area will be drawn down to 15 to 17 feet bgs.

not low enough

Because of the high water table in the Still Bottoms Pond Area (3~5' bgs), this area will require dewatering prior to implementation of ISVE. This area will be dewatered to a depth of approximately 8 to 10 feet bgs, exposing the areas with the largest mass of contaminants for extraction through the ISVE system.

The areas of contamination that will remain below the water table are relatively small compared to the areas that will be treated with ISVE. These areas are also contained within the barrier wall and if the contaminants in these areas dissolve in the groundwater, they will be removed by the groundwater extraction system and treated in the water treatment plant.

## 4.1 ALTERNATES EVALUATION

Preliminary evaluations were conducted in order to determine the most effective method of dewatering the Site, given the capacity limitations of the existing extraction trenches (the barrier wall extraction system - BWES) and the groundwater treatment system. Several different options were evaluated:

1. Use of the existing BWES trenches to dewater the Site.

2. Use of the existing BWES trenches to dewater and installation of a separation barrier between the Off-Site Containment Area and the ACS facility.

3. Use of the existing BWES trenches, installation of a separation barrier, and installation of a series of well points around the Still Bottoms Pond Area to locally dewater this area.

4. Use of the existing BWES trenches, installation of a separation barrier, installation of well points, and installation of sheet piling around the Still Bottoms Pond Area to locally dewater this area.

To evaluate these options, the storm water infiltration through various parts of the Site was calculated and converted to a flow rate into the dewatering system. The effective pumping rate out of the dewatering system was then calculated as the actual pumping rate minus the infiltration rate. Several different covering and cover scenarios were assumed during evaluation of infiltration rates through the ACS operating facility and the Off-Site Area. For each option, a design pumping rate and an elapsed time to dewater were calculated. Criteria for evaluating effectiveness include the pumping capacity of the trenches, the volume and treatment capacity limitations of the groundwater pump and treatment system and the time required to lower the water table in relation to implementation of the ISVE systems. The results of the evaluation indicated that Option 2 was the most cost effective. Details of the evaluation are included in Appendix C.

need to increase vol/capacity

## 4.2 SELECTED ALTERNATIVE

Not good enough.

Option 2, installation of a separation barrier and use of the existing trenches to dewater both Off-Site and On-Site Areas, was determined to be most cost effective, because the option prevents exceeding the capacity of the trenches and treatment system while minimizing the time required to implement remediation. Therefore, the Alternate Remedy includes installing a separation barrier wall just south of the existing railroad tracks, at the south edge of the ACS operating facility. Because the ISVE system will begin in the Off-Site Containment Area, this area will be dewatered first, allowing optimization of the ISVE system to extract vapors from the majority of the contaminated area. The existing trenches in the Off-Site Area will pump at 25 gpm (5 gpm from each trench) to dewater the Off-Site Area. Following installation of the separation barrier (slurry wall), the Off-Site Area will be surrounded by a barrier wall on the east, south and west sides, a clay layer below, a one-foot cover on top, and the separation barrier on the north. Therefore, the infiltration into this area is expected to be less than 5 gpm. Once the area is dewatered (which should take approximately 7 to 8 months), extraction from the trenches can be "throttled back" to produce a flow rate just equal to the infiltration rate. Matching the infiltration rate will keep the water table lowered to expose the majority of the VOC mass while the ISVE is in operation and to keep the water level below the barrier wall after the ISVE system is shut-down.

which is?

Following the water table lowering in the Off-Site Area, the Still Bottoms Pond Area water table will be lowered. Because the Off-Site Area will require only 5 gpm to maintain the lowered water table, the remaining pumping capacity will be used in the three BWES trenches in the ACS facility. Additional pumps will be installed in these three trenches, to boost their extraction capacity, and they will be operated at approximately 35 gpm (10-12 gpm per trench) to dewater the On-Site Area. Based on our evaluation, lowering the water table in this area should take approximately six to seven months. Prior to dropping the water table in the Still Bottoms Pond Area, the existing Fire Pond will be filled, the ACS Site will be regraded to more effectively drain storm water, and the Still Bottoms Pond Area will be covered to reduce infiltration. (See Figure 9).

As a contingency, if the trenches in the ACS facility are not able to dewater the Still Bottoms Pond Area effectively, well points would be installed near the Still Bottoms Pond Area to locally dewater this area. However, because the treatment capacity of the groundwater treatment system is limited, and the water extracted from well points very near the contaminant source are likely to be highly contaminated, this alternative will be avoided, if possible. ~~If unavoidable~~, it ~~may be~~ will be necessary to add temporary treatment capacity to the groundwater treatment system to deal with the additional flow and contaminant loading.

# 5.0 COVER AND COVER DESIGN

As discussed in Section 2.2, the proposed alternate remedy includes covering the areas of the Site containing buried waste, as defined in the SOW. The Still Bottoms Pond Area and the Off-Site Area (including the Off-Site Containment Area, the area contiguous to the City of Griffith landfill, and the Kapica-Pazmey Area) are the two areas of the Site that will be covered. Both of these areas contain concentrations of VOCs and PCBs in the defined as buried waste which must be addressed as part of the Site remedial action. In addition, the Kapica-Pazmey section of the Off-Site Area contains elevated concentrations of lead in the soil. The main objectives of covering these areas are:

1. Eliminate potential direct contact with VOC- and PCB-contaminated soils (and lead-contaminated soils in the Kapica-Pazmey Area);

2. Eliminate potential worker contact with VOC-contaminated groundwater;

3. Reduce the potential for contaminant migration to groundwater by reducing infiltration to these areas; and

4. Provide a surface seal for the ISVE system, to minimize potential short-circuiting and maximize the capture of VOC vapors.

In addition, covering these areas will reduce the storm water infiltration into the area inside the barrier wall, thereby reducing the amount of groundwater to be treated by the groundwater treatment plant.

## 5.1 COVER REGULATIONS

Because covering was not a part of the original ROD, the requirements for covering at the ACS Site are not outlined in the SOW. Therefore, several regulatory references were used in the evaluation of various alternatives for the cover (4, 5). An evaluation of conventional and alternative designs was conducted to determine an appropriate covering remedy design. Both Federal (U.S. EPA Subtitle D) and Indiana Department of Environmental Management (IDEM - Municipal and Hazardous Waste Landfills) regulations were used to provide potential design criteria for the evaluation. These regulations are particular to solid and hazardous waste landfills, and therefore are not applicable to the ACS Site. However, they are relevant and may be appropriate for the final cover selection. IDEM was contacted directly to discuss the relevant and appropriate requirements, and recommended 329 IAC 10-22-7 and deferred to U.S. EPA requirements to be used as guidance for the cover design. This guidance requires the equivalent of a model RCRA cover (composite cover with methane vent layer, drainage layer, frost protection layer, topsoil and vegetation) that is 60 inches thick. However, the methane vent layer and drainage layer are unnecessary at the ACS Site, as explained in the following sections.

### 5.1.1 Methane Collection

Because of the landfilled nature of the Off-Site Containment Area, methane generation in this area could be a concern following the installation of a engineered cover. However, because the ISVE system in this area will extract and treat the vapors from within this area, the need for a methane collection or vent system is eliminated. For long-term venting, following the shut-down of the ISVE system, the ISVE wells will be modified to serve as passive vent points.

Methane generation is not anticipated at the Still Bottom Ponds Area, but is possible if there is anaerobic biodegradation occurring in the subsurface soil. As with the Off-Site Containment Area, the methane, if generated, will be removed through the ISVE wells either under an active or passive operation.

### 5.1.2 Drainage Layer

Although a requirement of the model cover referenced in the 329 IAC and U.S. EPA Guidance, drainage layers for the covers at the ACS Site are unnecessary. Because of the low slopes associated with the covered areas (1% in the Still Bottoms Pond and 1-8% in the Off-Site Area), a drainage layer would not effectively collect significant volumes of water. This is supported by the HELP analyses included in Appendix D.

Furthermore, because the ACS Site is an operating facility with truck and equipment traffic, process and water pipes, storage areas, existing above ground tank, existing buildings and other structures the profile of the cover must be minimized especially on the Still Bottoms Pond Area. Therefore, alternatives to the model cover are being evaluated.

## 5.2 ALTERNATIVES EVALUATION

Various cover configurations are being evaluated for regulatory acceptance, effectiveness in the infiltration reduction , integration with the ISVE system, costs (qualitatively at this point), and coordination with the ACS operating facility ongoing production activities. For example, the cover to be placed on the Still Bottoms Pond Area must:

- Significantly reduce the storm water infiltration through this area,
- Comply with relevant and appropriate regulatory requirements,
- Provide an adequate surface seal for the ISVE system, and
- Be cost effective

Further, if possible, the cover should:

- Minimize disruption to the ACS operating areas, and allow access to operational areas within the ACS facility

The first part of evaluating the types of covers that are acceptable is to determine the effectiveness of reducing infiltration. Infiltration through the covers was evaluated by using the Hydrologic Evaluation of Landfill Performance (HELP4) Model (7). The model is a two-dimensional iterative hydrological model of water movement across, into, through, and out of impacted soils and landfills.

The HELP4 model was used to compare the performance of eight standard and alternative cover designs. Weather data utilized for the evaluation were generated by the HELP model as default values for Chicago, Illinois, and were constant for all modeled alternatives. Variables for the modeling input included cover design layer-characteristics such as soil and geosynthetic layer types and thickness. Table 2 summarizes the modeled output results from selected cover and cover alternative design scenarios. Appendix D contains the complete model input and output.

## 5.3 PROPOSED COVERS

Based on the HELP model results, discussions with IDEM, consideration of potentially relevant and appropriate requirements and coordination with the ACS operating facility, the following covers are proposed.

### 5.3.1 Still Bottoms Pond Area

The alternatives for covering the Still Bottoms Pond Area considered two scenarios: a cover for operating site area and a cover for non-operating site area. The cover for a non-operating site area was evaluated for the Off-Site Containment Area and will not be further evaluated here. The cover for the operating site were focused to two types, following the initial evaluation:

1. A composite cover with gravel cover, incorporating asphalt access roads.
2. An asphalt cover with composite low-permeability zone and wearing surface.

The area to be covered in the Still Bottoms Pond Area is shown on Figure 9, along with sections of the covers. The actual final cover profile is still being evaluated and will depend on the operating requirements worked out with ACS Inc. For example, because of the insurance stipulations of the ACS facility, vegetation is not permitted within the ACS facility, therefore, neither of the two alternatives for the operating areas includes any form of vegetative cover. → so evapotranspiration is out. ?

Either alternative would consist of covering the Still Bottoms Pond with 12 inches of compacted clay, covered by geotextile, and six inches of gravel/slag as the initial layers of the final. These initial layers will be constructed as an interim cover prior to lowering the water table and installation of the ISVE system to reduce infiltration while dewatering. The final profile of the cover is still being evaluated and may depend on operating needs of the ACS plant.

Table 2. HELP4 Results for Modeled Scenarios
ACS NPL Site

| Trial Cover Design Number and Description | | Average Annual Totals inches | cubic feet | percent | Peak Daily Values inches | cubic feet |
|---|---|---|---|---|---|---|
| **Offsite Cap Design** | | | | | | |
| Cap 1 - Standard RCRA Model Cap | (6"OL, 18"ML, 12"SP, FML, 24"CL) | | | | | |
| Precipitation | | 34.15 | 647,013 | 100 | 4.64 | 87,921 |
| Runoff | | 2.86 | 62,407 | 8.39 | 2.06 | 44,851 |
| Evapotranspiration | | 25.47 | 554,649 | 74.58 | -- | -- |
| Percolation Through Cover | | 0.00021 | 4.65 | 0.00062 | 0.00046 | 10.11 |
| Lateral Drainage Collected | | 5.8 | 126,345 | 16.99 | 0.03 | 651 |
| Cap 2 - Alternative Cap | (6"OL, 18"ML, Geosynthetic, FML, GCL, 12"CL) | | | | | |
| Precipitation | | 34.15 | 647,013 | 100 | 4.64 | 87,921 |
| Runoff | | 5.17 | 112,633 | 15.15 | 2.27 | 49,451 |
| Evapotranspiration | | 28.97 | 630,898 | 84.83 | -- | -- |
| Percolation Through Cover | | 0.0038 | 83.08 | 0.011 | 0.00022 | 4.71 |
| Cap 3 - Alternative Cap | (6"OL, 12"ML, 0.2" FML, 12"CL) | | | | | |
| Precipitation | | 34.15 | 743,693 | 100 | 4.64 | 101,059 |
| Runoff | | 5.17 | 112,659 | 15.15 | 2.27 | 49,439 |
| Evapotranspiration | | 28.97 | 630,903 | 84.8 | -- | -- |
| Percolation Through Cover | | 0.0034 | 73.6 | 0.0099 | 0.00026 | 5.68 |
| **Offsite Cover Design** | | | | | | |
| Offsite cover - Cover Area Limiting Rainfall Infiltration | (6" OL, 12"CL) | | | | | |
| Precipitation | | 34.15 | 867,642 | 100 | 4.64 | 117,902 |
| Runoff | | 7.761 | 197,206 | 22.73 | 3.53 | 89,879 |
| Evapotranspiration | | 25.07 | 636,995 | 73.42 | -- | -- |
| Percolation Through Cover | | 1.32 | 33,441 | 3.85 | 0.01 | 259 |



APE/BPG
J:\1252\042\260101\CAPPINGEFFORT\HELP Final Caps.xls
1252042.260101

### 5.3.2 Off-Site Containment Area

Several cover alternatives for non-operating areas, such as the Off-Site Containment Area were evaluated and narrowed to a single alternative. The cover will be placed only over those area were there is buried waste as defined in the ROD and over areas of Griffith Landfill that extend of the Site. Twelve inches of compacted clay (much of which has already been placed) will be installed as an interim cover during initial operation of the ISVE system. Following initial start-up, a FML would be installed over the clay, to provide the primary low-permeability layer. A 12-inch root zone would be installed over the FML layer, and finally a six-inch topsoil layer would be installed and seeded to provide vegetative cover.

Outside of the covered Off-Site Containment Area, infiltration will be minimized possibly with a cover installed over this area. The cover would consist of 18 inches of compacted clay, covered with six inches of topsoil and vegetated. The areas and typical sections for the covered and covered areas, based on the information provided herein, are shown on Figure 10.

## 5.4 SURFACE WATER DRAINAGE CONTROL

The surrounding Off-Site and On-Site areas will be graded to improve storm water run-off and prevent storm water run-on. The drainage ditches and swales will be lined with appropriate erosion control measures, such as straw matting, silt fencing, hay bales, riprap, where necessary. The areas that currently pond water on the ACS facility will be regraded to drain into the existing storm sewer system, or off-site to the north or west wetlands. The drainage patterns for both the On-Site Area, and the Off-Site Area, are shown on Figures 9 and 10.

## 5.5 COVER IMPLEMENTATION

The first layer of the final covers will be placed as a temporary cover on the Still Bottoms Pond Area and the Off-Site Containment Area, and will consist of 12 inches of compacted clay, to provide a surface seal during the ISVE Start-Up. The 12 inches of clay will serve as a temporary cover for the ISVE areas, and will allow adjustments to be made in the ISVE systems (piping modifications, repairs, valve or port additions, etc.) during initial start-up of the ISVE systems.. In this manner, damage to the final cover due to these potential adjustments will be avoided. Following initial ISVE system start-up, the final cover can then be constructed atop the initial 12-inch clay layer, taking care to incorporate the ISVE wells into the final cover surface. Because the Off-Site Area currently has approximately 12 inches of compacted clay in place, the placement of the first layer of the cover will be relatively simple, to consist of minor regrading and recompaction. In the Still Bottoms Pond Area, the existing gravel/slag base will be scraped up to a depth of approximately 12 inches, the ISVE system will be installed, and 12 inches of clay will be placed and compacted. The gravel/slag will then be reused to construct access roads on top of the 12-inch clay layer.

no freeze / thaw protection

## 6.0 DRUM REMOVAL IN THE ON-SITE CONTAINMENT AREA

The On-Site Containment Area contains buried drums that were identified using historical aerial photographs, geophysical investigations, and test pitting. In addition, during installation of a water line from the ACS facility to the groundwater treatment plant, several buried drums were noted in the side wall of the excavation. The drums discovered during test pitting and installation of the water line appear to have been stacked three high, and are generally intact. They are buried from 1 to 2 feet deep, and extend to approximately 8 to 10 feet below the ground surface. These area are shown on Figure 2.

Based on the geophysical investigation conducted in 1991, during the remedial investigation of the Site, one particular area of the On-Site Containment Area was identified as containing a group of relatively intact drums. Based on the apparent areal extent and subsequent test pitting to determine the depth of the drums, this area was estimated to contain up to 1000 drums. The geophysical investigation conducted in 1998, which identified two more areas of probable buried drums, resulted in a revised estimate of up to approximately 2,500 buried drums, based on total areal extent and the assumption that the drums are stacked 3 high in the subsurface. It has not been confirmed that these areas do contain drums, but these areas will be investigated to confirm and delineate the extent of buried drums and to determine the drums' integrity prior to excavation.

### 6.1 DRUM REMOVAL WORK PLAN

The proposed drum removal in the defined areas would be conducted in accordance with the June 1997 Drum Removal Work Plan, submitted at the request of U.S. EPA and incorporated herein by reference. The objective of the drum removal is to excavate and dispose of drums in the On-Site Containment Area. The areas to be excavated would be based upon the geophysical investigations and would be staked in the field after confirming and delineating the location of drums the prior to excavation.
In general, the drums within the areas defined by the geophysics will be excavated and staged in a lined, bermed area near the excavation. Air monitoring will be implemented to ensure a safe working environment, and work will begin in Level B personal protective equipment. Each drum will be fingerprinted to determine the waste characteristics, and then drums will be segregated into similar and compatible waste streams. Composite samples of each waste stream will be collected and analyzed to obtain disposal authorization. Following receipt of the analytical data from the waste streams, a waste evaluation report will be submitted to U.S. EPA, with recommendations on disposal alternatives for the drums. Upon U.S. EPA approval, the drums will be sent off-site for incineration, following applicable manifesting and transportation regulations. Drums that are not intact would be bulked for shipment. Drums not accepted at an off-site disposal facility would be buried in the existing Fire Pond (part of the Still Bottoms Pond Area), within the area to be covered and treated with ISVE. Contaminated soils that are excavated during the drum removal would also be placed in this area to be treated with ISVE.

# 7.0 OFF-SITE GROUNDWATER TREATMENT

Two areas of upper aquifer groundwater contamination have been delineated at the ACS Site. The shallow groundwater plume extending approximately 700 feet north from the ACS facility has been termed the North Area and a plume extending approximately 2,000 feet to the east-southeast has been termed the South Area. Localized contamination has been documented in the lower aquifer near monitoring well MW-9. This contamination appears to be a direct result of leakage along the well casing at monitoring well MW-9 and does not appear to be part of a wide spread release into the lower aquifer. The well has been abandoned and replaced with MW-9R, future monitoring will be used evaluate whether or not the source of lower aquifer impact has been eliminated.

The outer line on Figure 1, marks the approximate extent of contamination in the upper aquifer at the site. These areas were formed when groundwater contaminants migrated away from the source areas, after ACS began operations in 1955. The installation of the barrier wall in 1997 cut off further migration of contaminants from the source areas to the groundwater in the North and South Areas. However, these two areas of groundwater contamination remain outside the barrier wall. The primary contaminants in the groundwater are benzene and chloroethane.

## 7.1 DESCRIPTION OF UPPER AQUIFER CONTAMINATION

The North and South Areas of Groundwater contamination coincide with the historical groundwater flow paths outward from the ACS facility. The North Area of groundwater contamination results from groundwater flow from the source areas inside the ACS facility toward the north and west. The South Area of contamination results from the groundwater flow path from the Off-Site Containment Area and Kapica-Pazmey Area to the south, southeast.

Currently, a natural attenuation study is being conducted in both the North and South Areas to evaluate the capacity of naturally occurring process, in the soil and groundwater to attenuate the contaminants within the plume. Periodic monitoring is being conducted at wells within each affected area and at the edges of each area to document any trends or constants in the groundwater quality and contaminant concentration. The results will be further evaluated by the application of modeling to assess the relative contributions of microbes in the soils, reductive dechlorination, volatilization, and dilution. The natural attenuation study was started during the third quarter of 1997, after the barrier wall was closed, cutting off the original source of the groundwater contamination from further migration to the affected areas.

### 7.1.1 North Area

Historically, groundwater in the North Area started inside the ACS facility and flowed to the west and north, where it discharged to surface water. To the west, the groundwater discharged into the wetlands within 200 to 500 feet of the ACS facility. Samples collected 800 feet directly west of the ACS facility (MW 46), have showed only trace levels of benzene, indicating the end of the area of contamination. To the north, groundwater discharged to the drainage ditch 400 to 600 feet northwest of the facility. Samples collected north of the ACS facility(from monitoring wells MW 48 and MW 49), have consistently contained elevated levels of benzene (up to approximately 9.5 ppm) and chloroethane (up to 1 ppm). Monitoring wells located further to the north show that the area of contamination ends in that direction (MW37, MW38, and MW39)

9500 ppb

The PGCS, shown on Figure 1, was installed specifically to halt the further off-site migration of contaminants to the north and west. Sampling indicates that the PGCS has been successful in capturing the contamination to the west of the ACS facility. However, monitoring results at MW48 and MW49 suggest that an area with benzene concentrations of up to 10 ppm that is beyond the hydraulic influence of the PGCS extraction system, and therefore, it represents a potential on-going "source" of contamination.

It is unlikely that natural attenuation will reduce the benzene concentrations to below MCLs within the next ten years, so active remediation of the source in this area is proposed in the Alternate Remedy. The remediation method proposed for this source is enhanced in-situ bioremediation through the addition of oxygen in the contaminant are using products such as Oxygen Release Compound (ORC®). ORC® is a formulation of magnesium peroxide that slowly releases (over 6 to 12 months) molecular oxygen when hydrated. The released oxygen enhances the naturally-occurring attenuation process in the zone of contamination. The oxygen introduced into the groundwater by ORC® promotes microbial growth and maximizes the ability of aerobic microbes to degrade the contaminants.

The remedial plan includes the treatment of an upper aquifer area, 100 by 100 feet, with a saturated thickness of 10 feet as shown on Figure 11. The theoretical ORC® requirement is based on the stoichiometric requirement of 3 oxygen molecules for every carbon molecule, and an oxygen content of 1 pound for every 10 pounds of ORC®. Calculations, based on a contaminant level of 9 ppm, indicate that approximately 150 pounds of contaminants exists in the plume area. Therefore, approximately 4,500 pounds of ORC® will be required to enhance the natural degradation of the benzene and chloroethane contained in the current source of the North Area.

Not useful w/ Chlor. +

The ORC® will be injected across the upper aquifer by geoprobe. The geoprobe will be used to punch vertical holes across the upper aquifer in an 100 by 100 foot array with ten foot spacing. The geoprobe will inject approximately 45 pounds of ORC® into each of 100 holes punched across the saturated thickness of the upper aquifer. Monitoring will continue at the monitoring wells in the vicinity and the results will be used in conjunction with the Natural Attenuation Investigation to evaluate the effectiveness of bio-attenuation, enhance by ORC®.



benzene = food for anaerobic decomp. of chlorinateds

### 7.1.2 South Area

An area of benzene and chloroethane contamination also extends approximately 2000 feet beyond the barrier wall towards the south-southeast in the upper aquifer. The historical monitoring data indicate contaminant concentrations are generally below 1 ppm in this area. Sampling results from monitoring wells MW41, MW42, MW43, MW44, and MW47, show that the extent of the contaminated areas has been defined (Figure 1). A portion of this plume area is located in what is essentially a low-lying wetlands area, which is conducive to the microbial activity integral to natural attenuation. Immediate active remediation is not planned for the South Area. It is also the subject of the natural attenuation study which will continue until the third quarter of 1999.

Decreases have already been noted in the benzene and chloroethane concentrations inside the South Area of contamination. On the basis of the monitoring data and estimates of natural attenuation based on the expected half-life for benzene in the upper aquifer, Montgomery Watson calculates that the benzene concentrations will be below the MCL of 5 ppb within ten years. By the end of 1999, the Natural Attenuation Study will have been completed and active remediation by ORC® will have been conducted in the North Area for one year. If the results of the Natural Attenuation study and concurrent monitoring indicate that benzene concentrations may not reach the MCLs within ten years, the experience gained from the ORC® application in the North Area will be applied to the South Area in developing an active remediation plan.

not soon enough.

# 8.0 MISCELLANEOUS ACTIVITIES

Several miscellaneous activities will be conducted as part of the final remedy for the Site. The following paragraphs briefly describe these miscellaneous activities:

- Removal and Consolidation of PCB-Impacted Sediments from a drainage swale in the Wetlands
- Consolidation of Miscellaneous Debris
- Upgrades to the Groundwater Treatment System
- Coordination with the ACS Plant Utilities

## 8.1 REMOVAL AND CONSOLIDATION OF PCB-IMPACTED SEDIMENTS IN THE DRAINAGE SWALE

The wetlands area to the west of the ACS facility, where the surface drainage runs away from the Site, has been found to contain PCBs in the sediments. The PCB contamination appears to be limited to the upper foot of sediment in this area, as defined in the Phase II Wetlands Investigation Report, February 1997 and shown on Figure 1. As part of the final remedy, this area will excavated to a depth of approximately 1 foot, and transported to the Fire Pond, where it will be graded in the area to be covered. The total volume of the PCB-impacted soils to be excavated is approximately 850 cubic yards, based on the areal extent and a 1-foot depth. Sediment samples will be collected from the floor and the sides of the excavation, to confirm that PCB concentrations greater than 1 ppm have been removed. The wetlands area excavation will be backfilled with hydric soils, and reseeded with native wetlands vegetation. No cat tails allowed.

## 8.2 CONSOLIDATION OF MISCELLANEOUS DEBRIS

Prior to installation of the cover or ISVE systems in the Still Bottoms Pond Area, the Fire Pond will need to be filled. If uncontaminated soils ("clean fill") from an off-site source were used to fill the Fire Pond, they would necessarily be placed in an area which is known to contain hazardous materials, thus rendering the "clean fill" contaminated. Instead, the placement of materials from several excavated areas on Site will be consolidated in the Fire Pond, to be covered and treated by ISVE. These materials include:

- the investigate-derived materials (soil cuttings)now contained in drums.
- Contaminated soil, debris, non-intact drums or drums from the drum removal activities in the On-Site Containment Area, that are not accepted at an off-site disposal facility.
- The PCB-impacted soils excavated from the wetlands area

- The soil from the spoils piles (VOC- and PCB-contaminated waste and soil) from the barrier wall installation that currently lie in the Off-Site Area.

The placement of these materials in the Fire Pond will eliminate the need to fill the Fire Pond with uncontaminated soil. By placing Site-derived materials into the Fire Pond, further contamination of "clean" materials will be avoided, and the materials which are placed in the Fire Pond will be conveniently located for covering and ISVE treatment.

## 8.3 GROUNDWATER TREATMENT PLANT UPGRADE

Montgomery Watson currently operates the groundwater treatment plant at the American Chemical Service NPL site in Griffith, Indiana. Groundwater is pumped from two sources: the Perimeter Groundwater Containment System (PGCS) and the Barrier Wall Extraction System (BWES). This treatment plant was designed to treat primarily groundwater from PGCS. However, in the recent past, with increased activated carbon cells, groundwater from the BWES has also been treated in this treatment plant. The groundwater characteristics from the two sources continually change. In order to continue treating the groundwater and not compromise the treatment efficiency, Montgomery Watson has identified specific upgrades/modifications that are necessary for this treatment plant. The following sections discuss the key upgrades/modifications that Montgomery Watson recommends be executed.

### 8.3.1 Install a Second Air Stripper

The concentrations of VOCs in the groundwater from the BWES source have increased. Currently, the existing groundwater treatment plant has a shallow tray air stripper to remove the VOCs. Because of the high VOC loading on the air stripper, a significant portion of the VOCs reside in the wastewater downstream of the air stripper and get adsorbed onto the activated carbon resulting in increased carbon replacement costs. In order to reduce the costs incurred in replacing activated carbon, Montgomery Watson proposes installing a second shallow tray air stripper in series with the existing air stripper.

### 8.3.2 Provide Outside Air Intakes for the Air Strippers

thermal oxidizer will have heat.

At the present time, air for the existing air stripper is drawn from inside the groundwater treatment plant building. Installation of a second air stripper will result in increased air intake for the air strippers from inside the building. The air inside the building is heated to a temperature of 70 degrees F during the winter. Continually drawing heated air for air stripping will result in increased utility consumption costs to maintain a heated environment inside the building. Montgomery Watson proposes that air intakes for the blowers be extended to outside the building. This should reduce the utility consumption costs.

### 8.3.3 Install Filter Upstream of the GAC Cells

Despite installing a clarifier and a sand filter prior to the activated carbon cells, there has been evidence of carbon fouling by particulate matter. Montgomery Watson installed a pilot cartridge filtration system upstream of the carbons and found considerable build up of particulate matter on the filter cartridges. Montgomery Watson believes that particulate matter smaller than 10 microns (μ) will escape collection in the sand filter and plug the carbon cells. Periodic backflushing of the carbon and early replacement of the spent carbon results in increased operating costs for the treatment plant. Installing a proper filtration system upstream of the carbon cells will lower the risk of carbon plugging and hence reduce such operating costs.

### 8.3.4 Phase Separator Installation

The concentrations of organic compounds in the BWES groundwater are high, and the groundwater that is extracted during dewatering may contain some free phase product. The existing separator at the groundwater treatment system can handle up to 35 gpm. However, during dewatering, this flow will likely be increased. Lack of phase separation will result in overwhelming specific treatment units such as the UV-Oxidation unit and the activated carbon cells. Therefore, more capacity is needed in the phase separator step of the treatment process. Hence, Montgomery Watson proposes installing a second phase separator to separate the free phase product from the groundwater.

### 8.3.5 Coagulant Delivery System

Montgomery Watson proposes to install a permanent coagulant feed system to the clarifier in the existing treatment plant. At the present time, Montgomery Watson uses a polymer in conjunction with a coagulant to achieve maximum solids removal in the clarifier. The coagulant addition system currently in place is a temporary arrangement. Montgomery Watson plans to properly engineer a permanent coagulant addition system and install it at the groundwater treatment plant.

### 8.3.6 Install a Final Biological Groundwater Treatment System

The existing ACS NPL Site groundwater treatment plant was designed to treat a maximum influent COD of 55 mg/L. The COD of the BWES groundwater has exceeded 1,000 mg/L, on occasion, and could reach higher levels in the future. The organic pollutants and COD are currently reduced in the UV-Oxidation system and the granular activated carbon columns. These two systems are not capable of adequately reducing the COD if the influent COD is in the range of 1,500 mg/L and therefore upgrades are required to treat additional BWES groundwater on a continuous basis.

Montgomery Watson currently is installing a biological treatment system pilot study consisting of 3 Fract tanks to provide activated sludge reactors and a sludge clarifier, and two blowers to aerate the system. To select the best approach and design for the long-term biological treatment at the Site, specific process information is necessary such as treatment efficiency, COD reduction, etc. Montgomery Watson proposes to operate the pilot system for four months while this process information is generated. Once the data from the interim biological treatment system is obtained, Montgomery Watson proposes that a full-scale permanent groundwater treatment system be designed and installed.

## 8.4 COORDINATION WITH THE ACS PLANT UTILITIES

A number of above ground and under ground utilities exist in the Still Bottoms Pond Area, inside of the ISVE system footprint. Because this area will be covered as part of the final remedy, intrusive activities within this area must be restricted. Therefore, the utilities within this area will need to be relocated or abandoned and structure will need to be removed or relocated The measures to be implemented in the Still Bottoms Pond Area to allow ISVE system installation and covering are provided on Figure 12.

The former tank farm, concrete foundations and slabs, utilities and other operating and non-operating facilities within the area to be covered and treated with ISVE will need to be addressed prior to construction. Coordination with the ACS Facility to determine operating requirements, if necessary in this area, will be conducted. To provide the operating ACS facility with access through the ISVE system area, an asphalt-paved access road may be installed through the ISVE system well field at the approximate location where the existing truck access road is located. The overhead pipe rack could be placed directly along side this road, and access to this area could then be allowed. Vehicle access to the remaining ISVE system area would be restricted.

# 9.0 PROPOSED PROJECT SEQUENCING

Because of the complexity of the project, and the interaction of the various components, a project sequence that illustrates the approximate time frames for each of the remedial components has been developed. The attached flowchart illustrates the dependence of certain components on others. For instance, the ISVE system in the Still-Bottoms Pond Area cannot be implemented before the dewatering in this area is complete; the covering of the Still Bottoms Pond Area cannot be started before the Fire Pond is filled; the Fire Pond cannot be filled before the PCB-contaminated sediments are excavated from the wetlands, etc.

# 10.0 REFERENCES


1. Pretreatment/Materials Handling Study Report, American Chemical Service (ACS) Site, Focus Environmental, Inc., October 1997

2. Thermal Treatability Study Report, American Chemical Service (ACS) Site, Focus Environmental Inc., December 1997

3. Final Report Feasibility Study, ACS NPL Site, Griffith, Indiana, Warzyn, Inc., June 1992.

4. The July 1989 RCRA Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments (PB89-233480)

5. RCRA covers and final covers for municipal solid waste landfills are described in 40 CFR 264 Subpart G and 329 Indiana Administrative Code (IAC) 10-22-7

6. EPA document 600/R-93/028 Decision-Support Software for Soil Vapor Extraction Technology Application: Hyperventilate

7. Hydrologic Evaluation of Landfill Performance Version 3.07 (HELP4), U.S. Army Corps of Engineers Waterways Experiment Station, United States Environmental Protection Agency Municipal Environmental Research Laboratory

8. ORC Applications Software Version 2.0, Regenesis


TLH/BPG/TAB/tab/dlp/emp/TLH/tlh
J:\1252\042\final remedy\conceptual_workplan.doc
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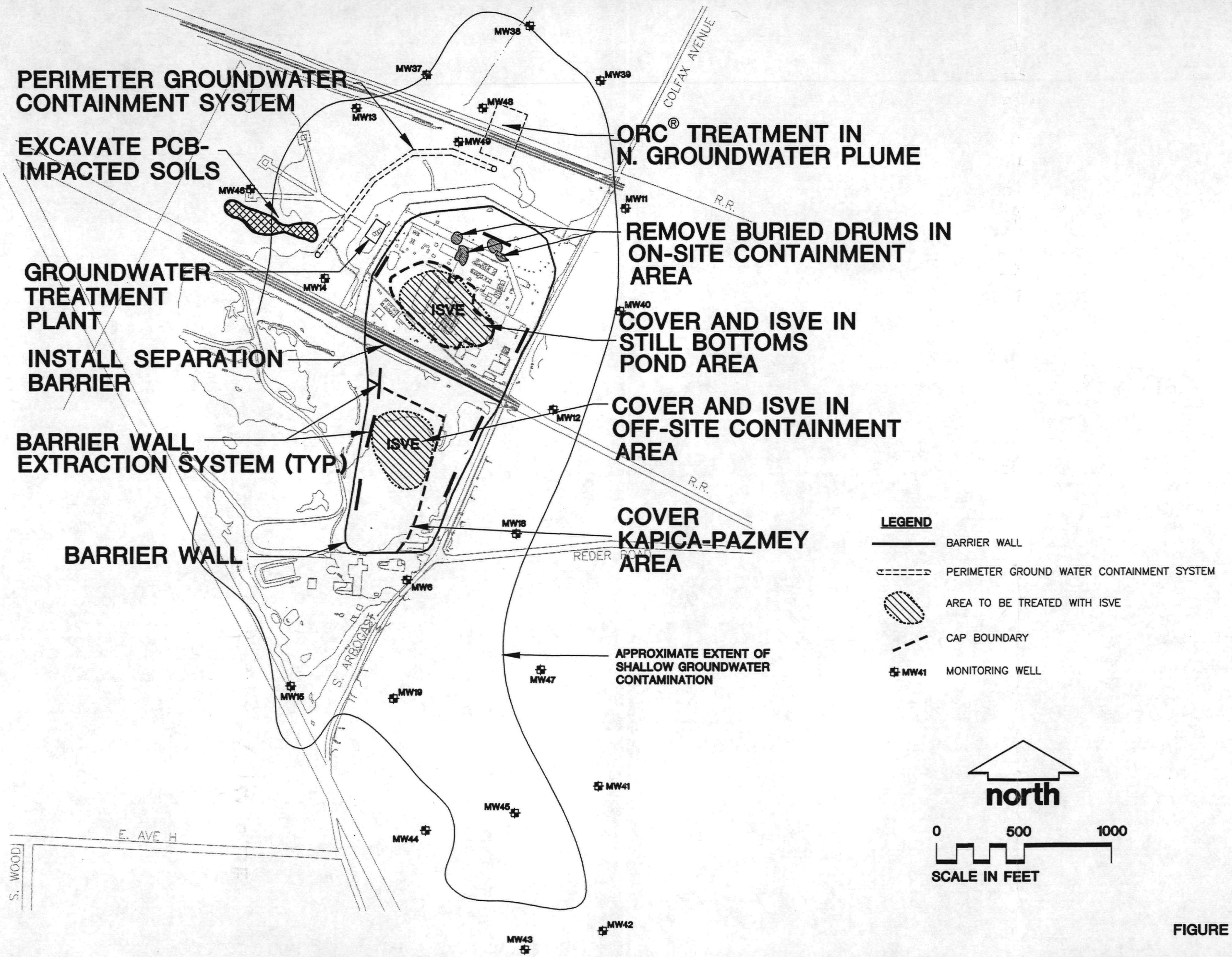


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QUALITY CONTROL

Graphic Standards
Lead Professional
Technical Review
Project Manager
Management Review
Other

PROPOSED REMEDIAL COMPONENTS
CONCEPTUAL DESIGN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Developed By TLH
Drawn By DKP
Approved By TAB
Date 8/6/98
Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/PRO_REM_COM.dwg
Revisions

Drawing Number
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260101 1

MONTGOMERY WATSON

FIGURE 1

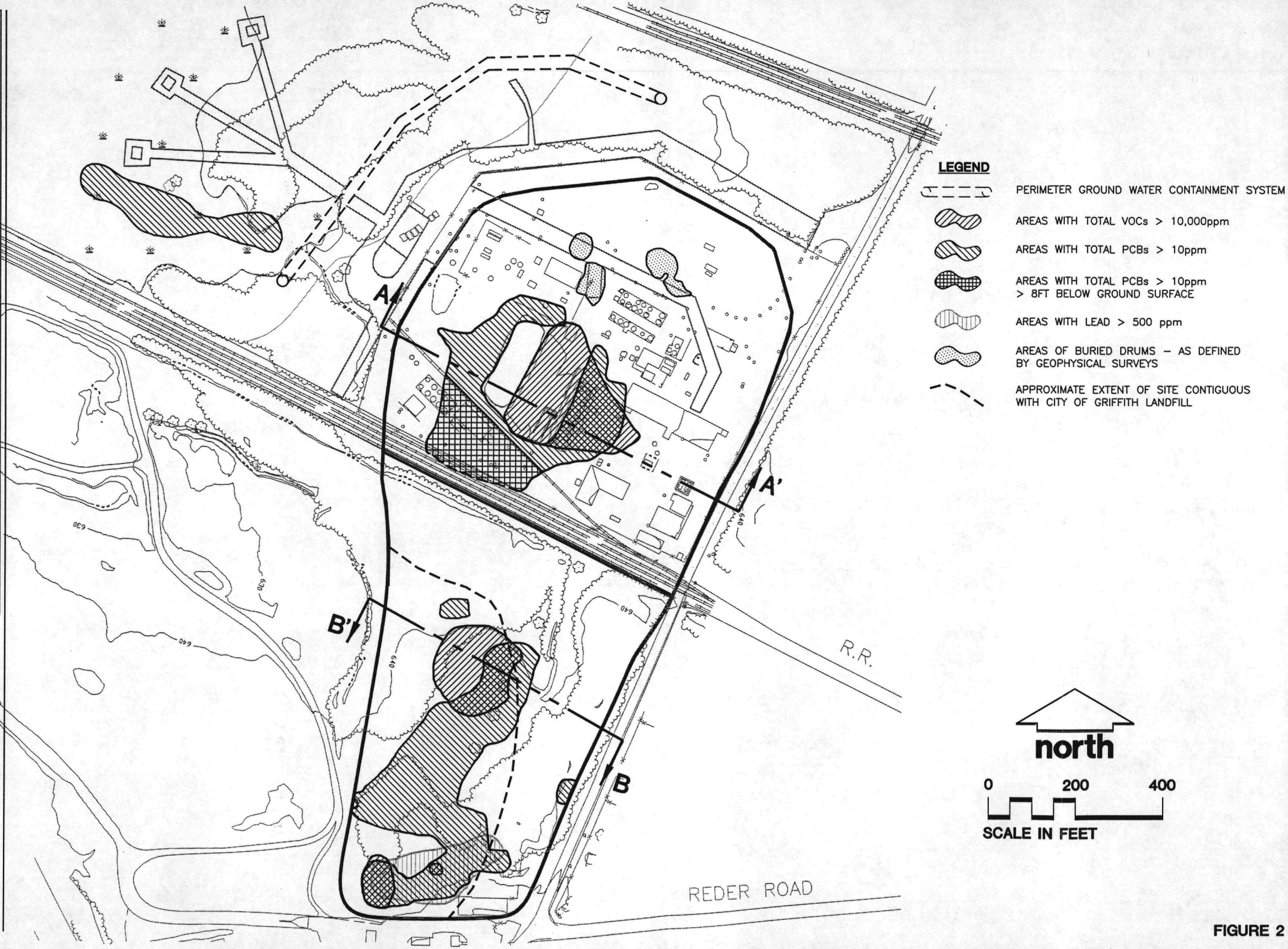


FIGURE 2

QUALITY CONTROL | Graphic Standards | Lead Professional | Technical Review | Project Manager | Management Review | Other

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Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/AREAS_SI_IMP.dwg
Revisions

**AREAS OF SOILS IMPACT**

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
1252042
260101 2

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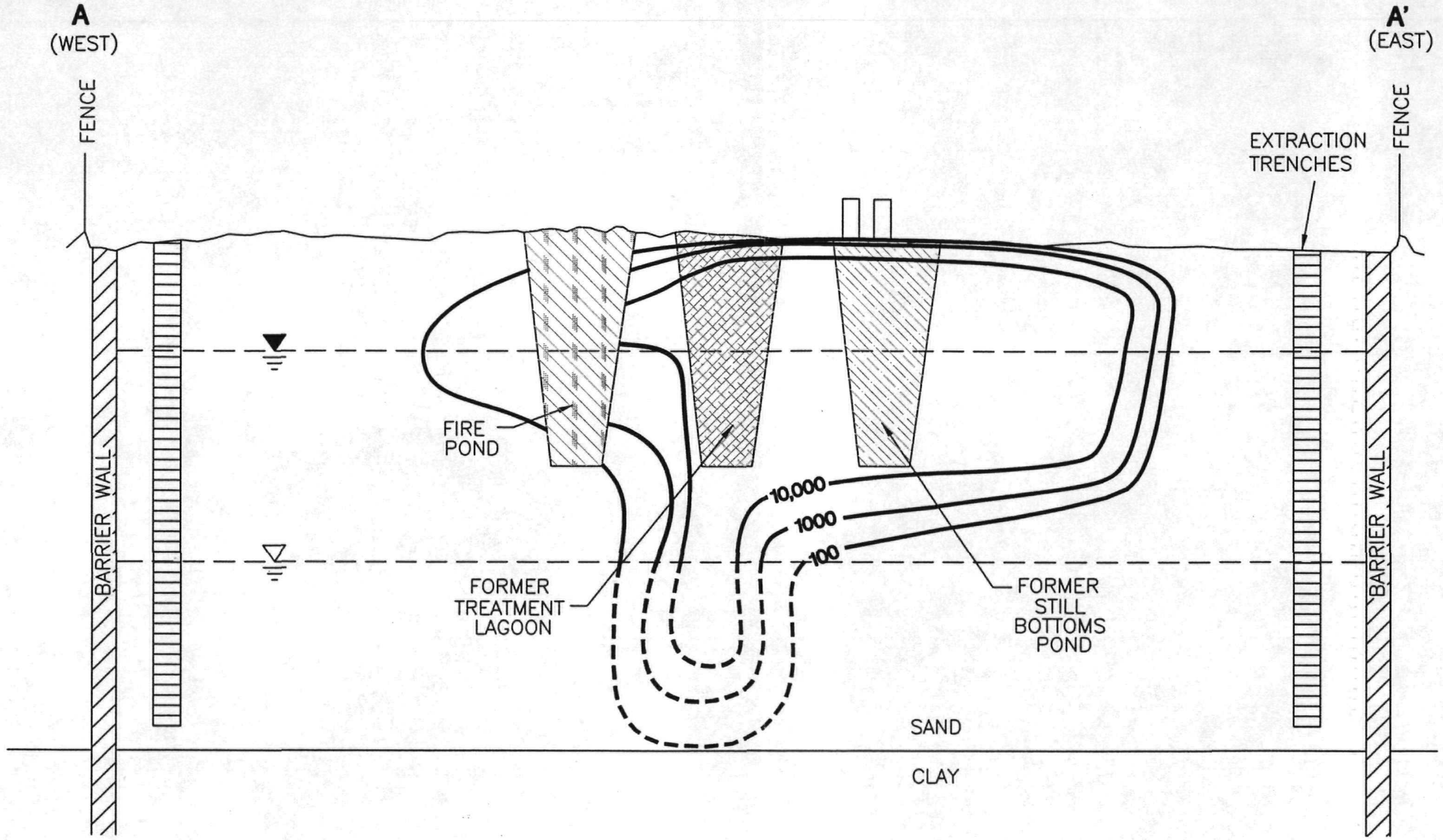


## LEGEND

100 — ISO-CONCENTRATIONS IN ppm

EXISTING GROUNDWATER LEVEL

FUTURE GROUNDWATER LEVEL

## NOTE

DASHED ISO-CONCENTRATION LINE INDICATES AREA IS EXAGGERATED, BASED ON A SINGLE SAMPLE

0 80

HORIZONTAL SCALE IN FEET

VERTICAL SCALE EXAGGERATED 16:1

FIGURE 3

STILL BOTTOMS POND AREA CROSS SECTION

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

| | |
|---|---|
| Developed By TLH | Drawn By DKP |
| Approved By TAB | Date 8/6/98 |
| Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/X-SEC_STL_BOTTOM.dwg | |
| Revisions | |

Drawing Number
1252042
260101 3

MONTGOMERY WATSON

| | | | |
|---|---|---|---|
| QUALITY CONTROL | Graphic Standards | Technical Review | Management Review |
| | Lead Professional | Project Manager | Other |

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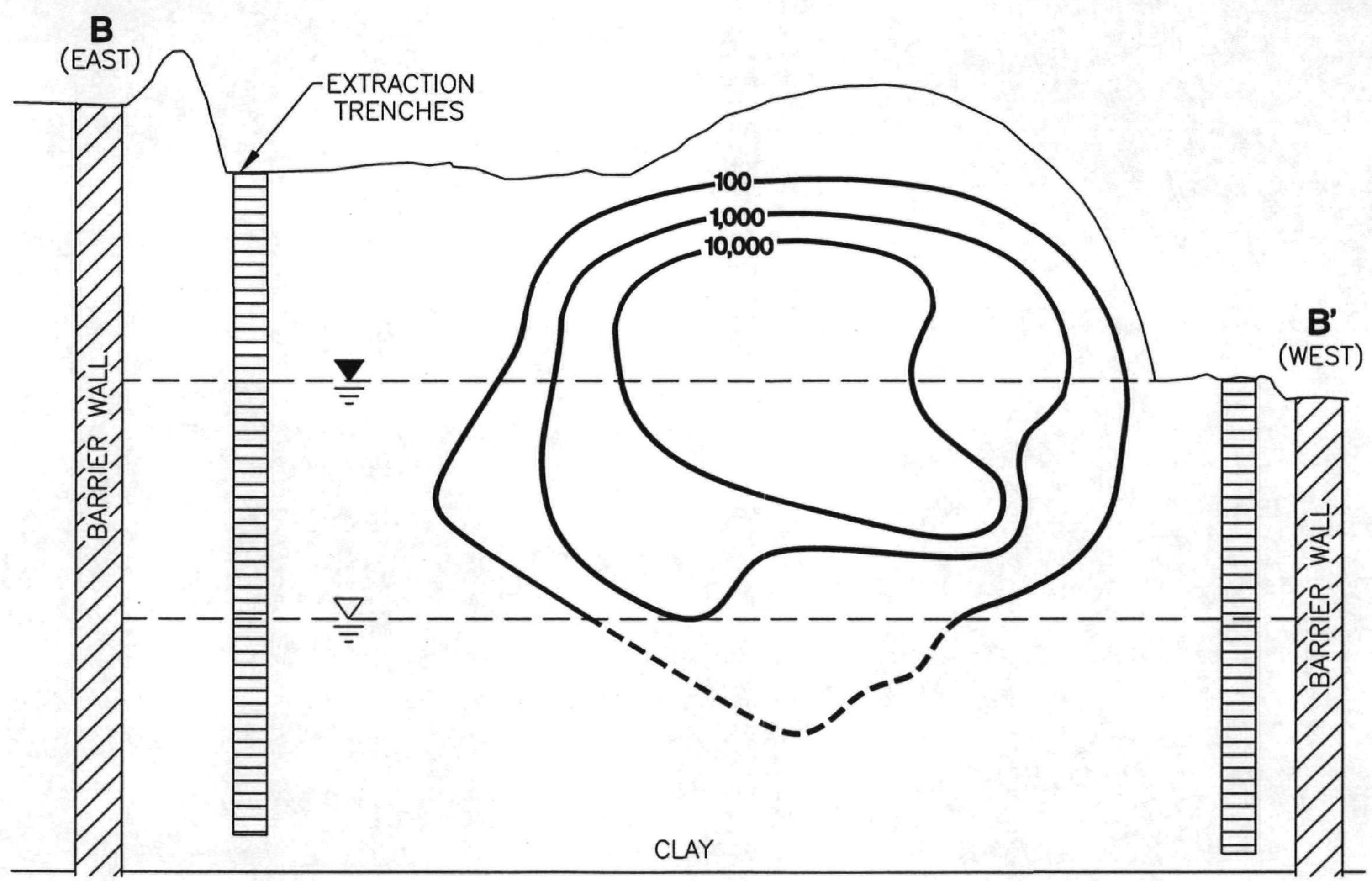
| QUALITY CONTROL | Graphic Standards | Technical Review | Management Review |
|---|---|---|---|
| | Lead Professional | Project Manager | Other |




**LEGEND**

100 — ISO-CONCENTRATIONS IN ppm

EXISTING GROUNDWATER LEVEL

FUTURE GROUNDWATER LEVEL

**NOTE**

DASHED ISO-CONCENTRATION LINE INDICATES AREA IS EXAGGERATED, BASED ON A SINGLE SAMPLE

0 80

**HORIZONTAL SCALE IN FEET**

**VERTICAL SCALE EXAGGERATED 16:1**

**FIGURE 4**

**OFF-SITE CONTAINMENT AREA CROSS SECTION**

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

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Drawing Number 1252042 260101 4

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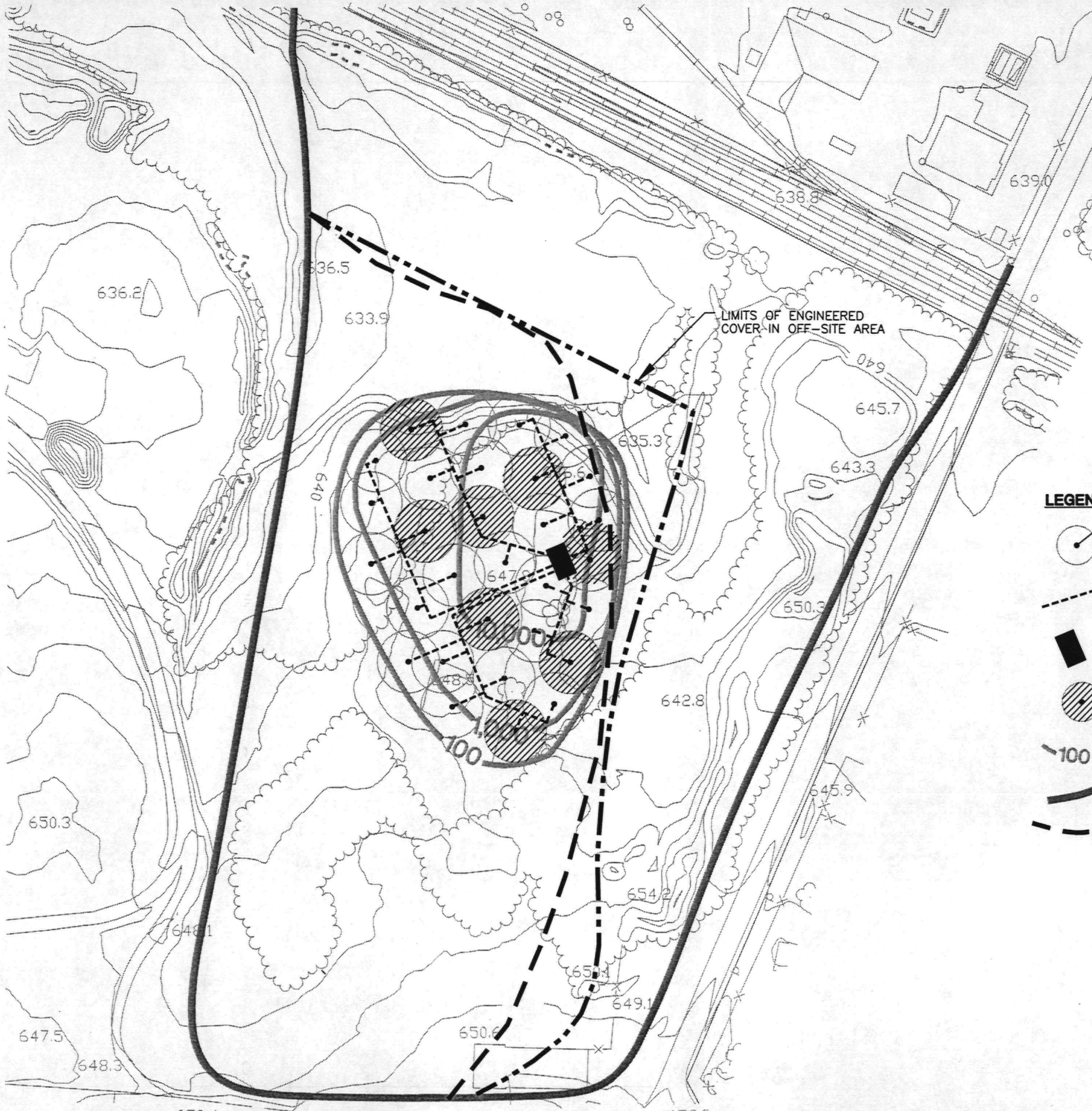
| QUALITY CONTROL | Graphic Standards | Technical Review | Management Review |
|---|---|---|---|
| | Lead Professional | Project Manager | Other |




**LEGEND:**

- SVE WELL (TOTAL OF 30)
- 30' RADIUS OF INFLUENCE (60' DIA. TOTAL)
- BURIED PIPING
- BLOWER SHED
- SVE WELL OPERATED FOR INITIAL START-UP
- 100 ISO-CONCENTRATION LINE IN PPM (ESTIMATED)
- BARRIER WALL
- APPROXIMATE EXTENT OF SITE CONTIGUOUS WITH CITY OF GRIFFITH LANDFILL

north

0 100 200

SCALE IN FEET

FIGURE 5

**OFF-SITE CONTAINMENT AREA - ISVE SYSTEM PHASE STARTUP**

SVE SYSTEM
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

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Approved By TAB
Date 8/6/98
Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/PHAS_STRT_OFF_SIT.dwg
Revisions

Drawing Number
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MONTGOMERY WATSON

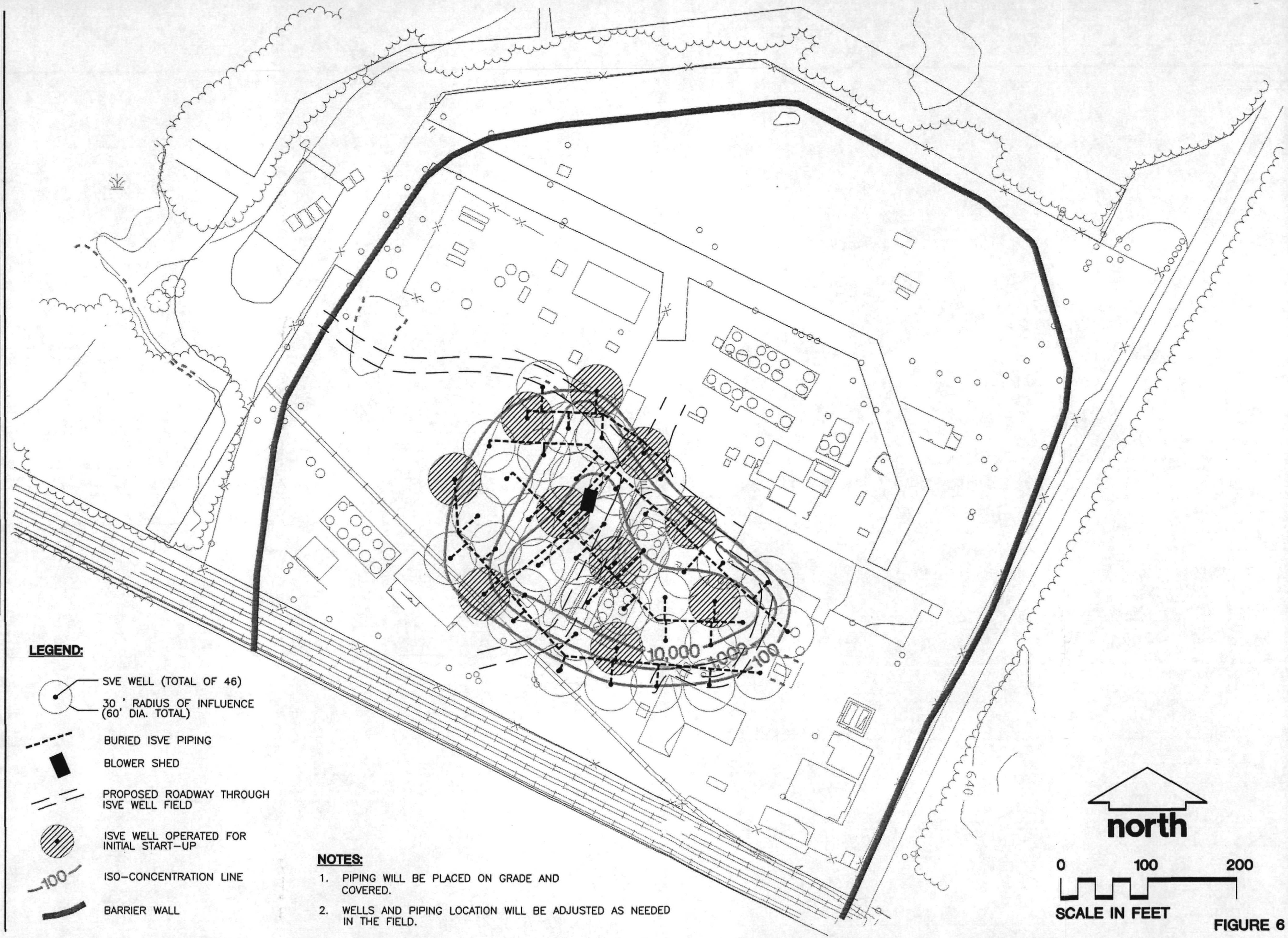


FIGURE 6

QUALITY CONTROL | Graphic Standards | Lead Professional | Technical Review | Project Manager | Management Review | Other

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**STILL BOTTOMS POND AREA - ISVE SYSTEM PHASED STARTUP**

SVE SYSTEM
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Developed By TLH | Drawn By DKP
Approved By TAB | Date 8/6/98
Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/PHAS_STRT_STL_BOT.dwg
Revisions

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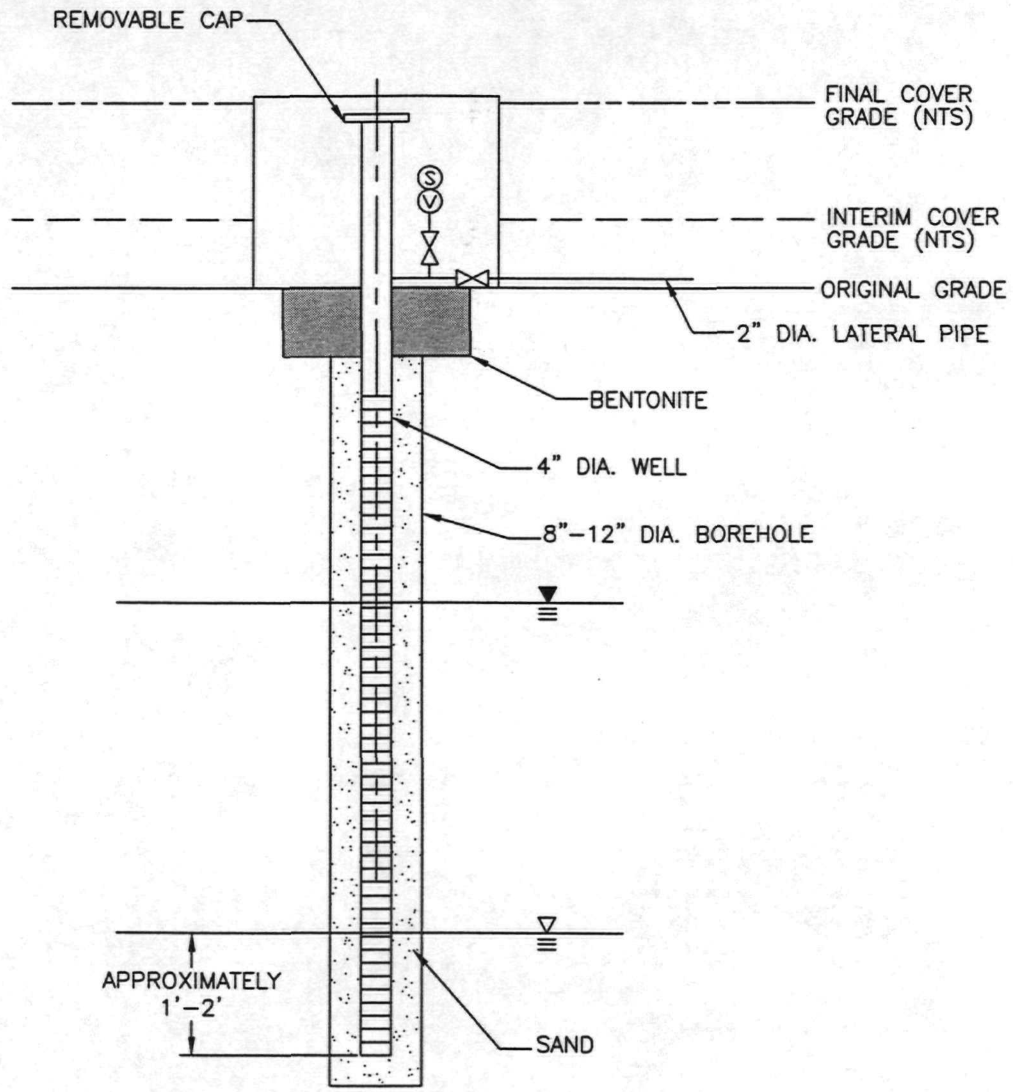
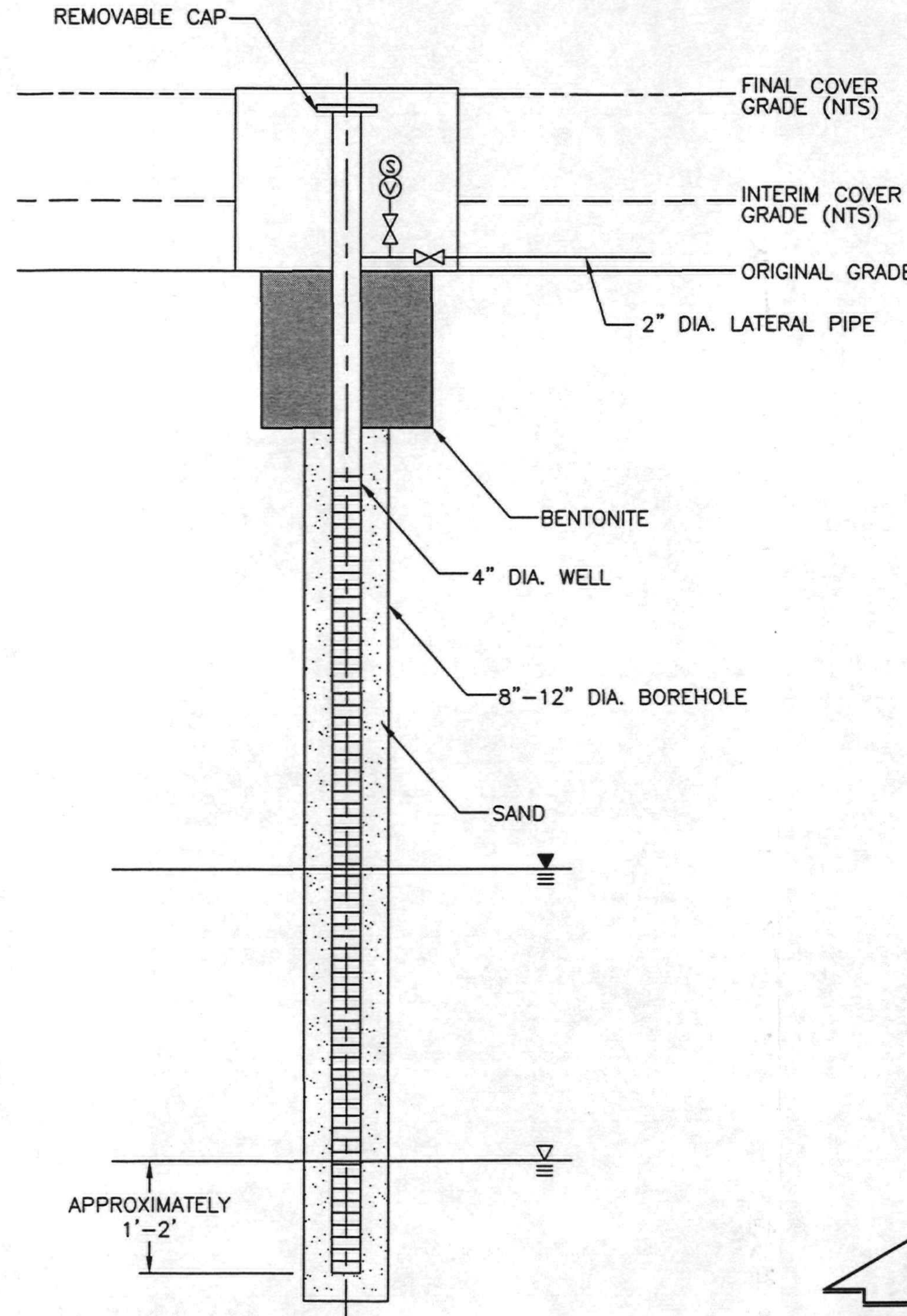
260101 6

MONTGOMERY WATSON




TYPICAL WELL HEAD - STILL BOTTOMS AREA




TYPICAL WELL HEAD - OFF-SITE AREA

**LEGEND**

| | |
|---|---|
| Ⓢ | SAMPLING PORT |
| Ⓥ | VACUUM |
| ⋈ | VALVE |
| ▽ | FUTURE GROUNDWATER ELEVATION |
| ▼ | EXISTING GROUNDWATER ELEVATION |

**NOTE**

NTS NOT TO SCALE

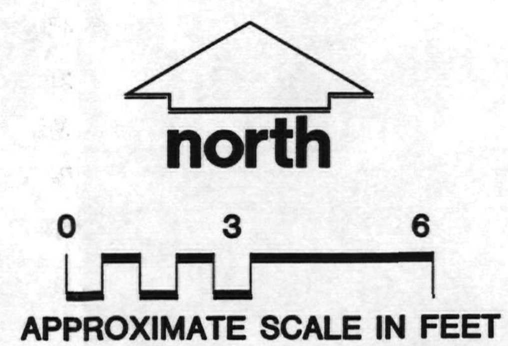



FIGURE 7

Management Review ___ Other ___
Technical Review ___ Project Manager ___
Graphic Standards ___ Lead Professional ___
QUALITY CONTROL



Developed By TLH
Drawn By DKP
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Date 8/6/98
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TYPICAL WELL HEAD DETAIL

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
1252042
260101 7

MONTGOMERY WATSON

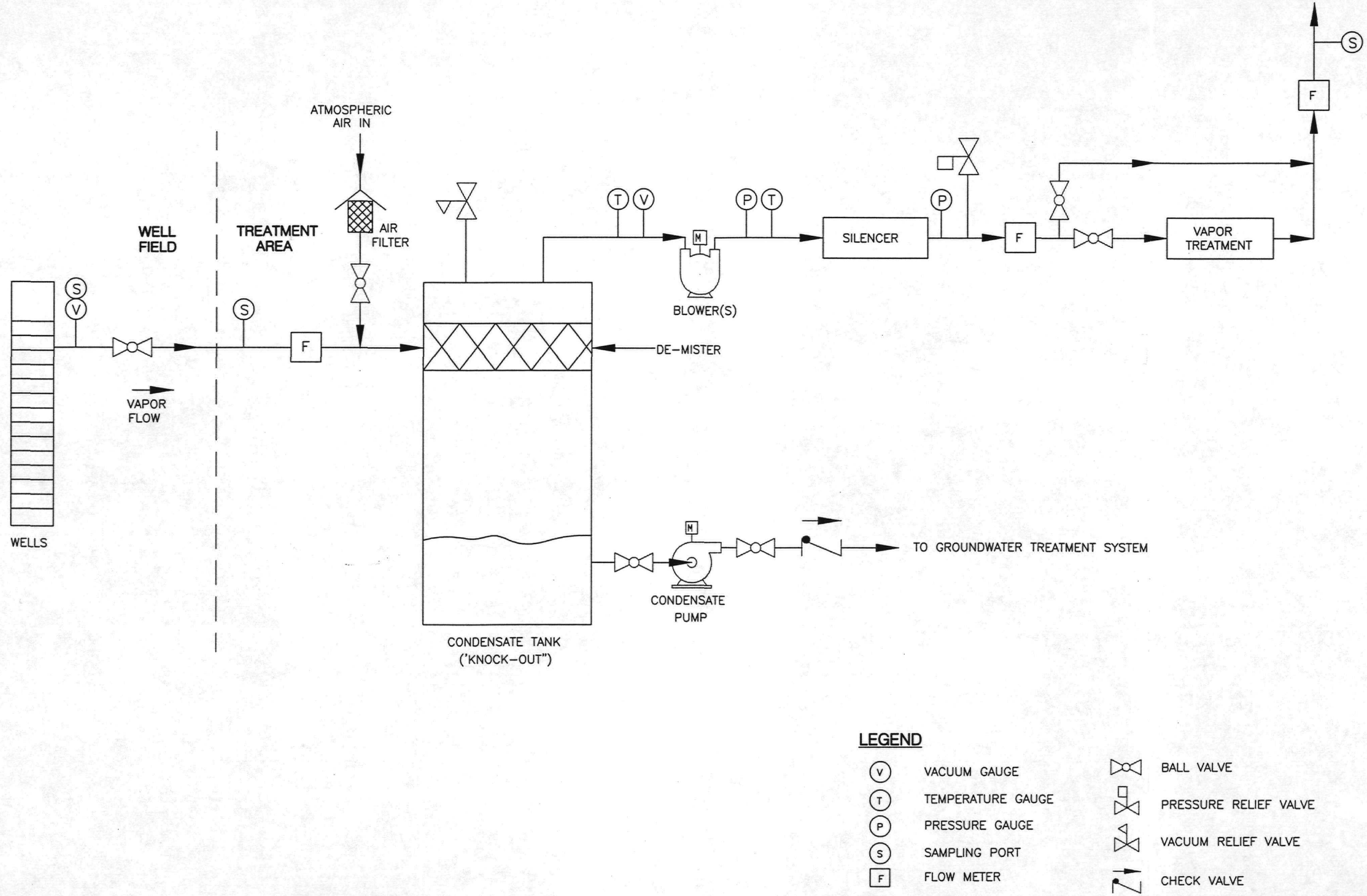


FIGURE 8

QUALITY CONTROL | Graphic Standards | Lead Professional | Technical Review | Project Manager | Management Review | Other

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**CONCEPTUAL PROCESS FLOW**

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

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Approved By TAB
Date 8/6/98
Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/FLOW_DIAGRAM.dwg
Revisions

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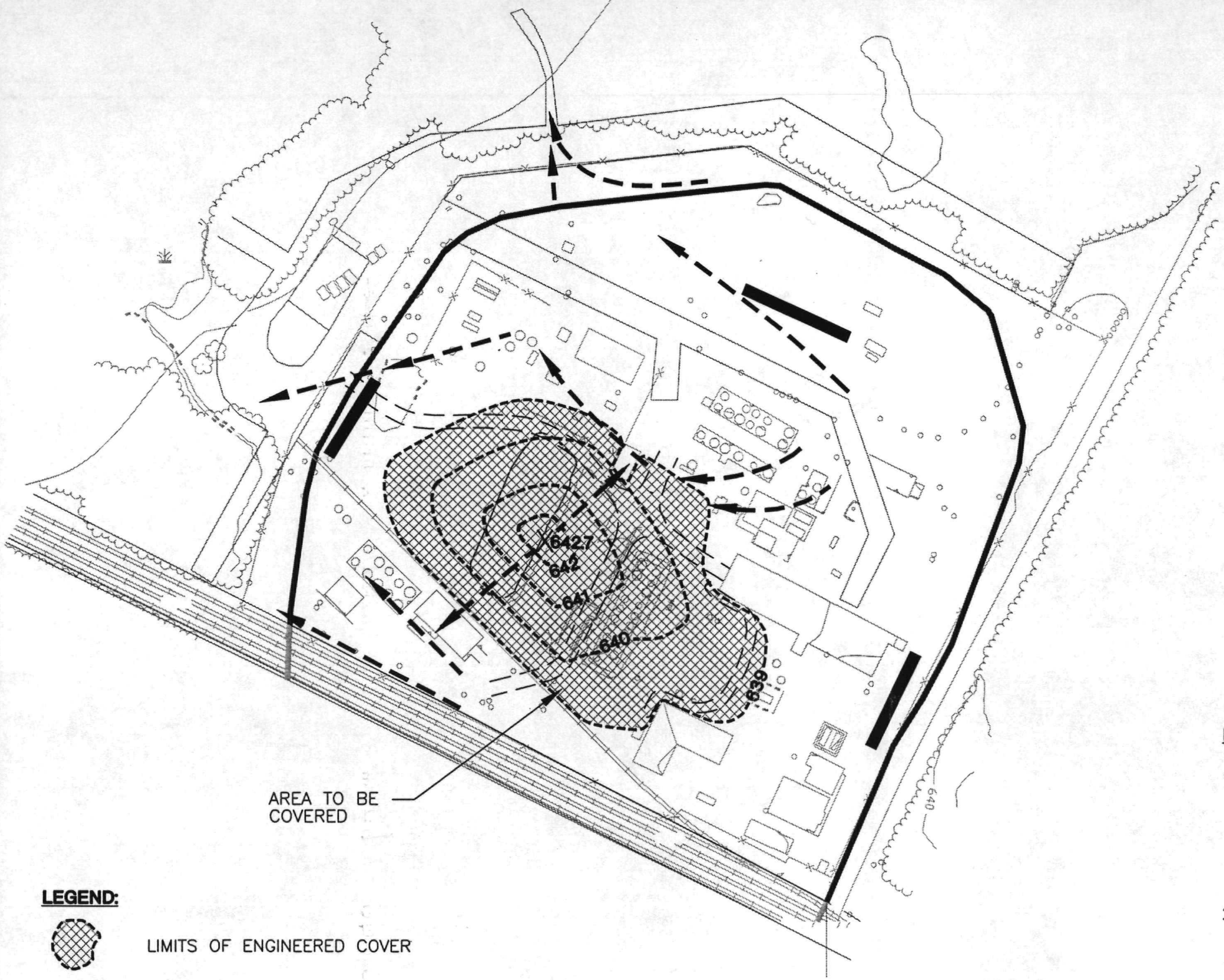
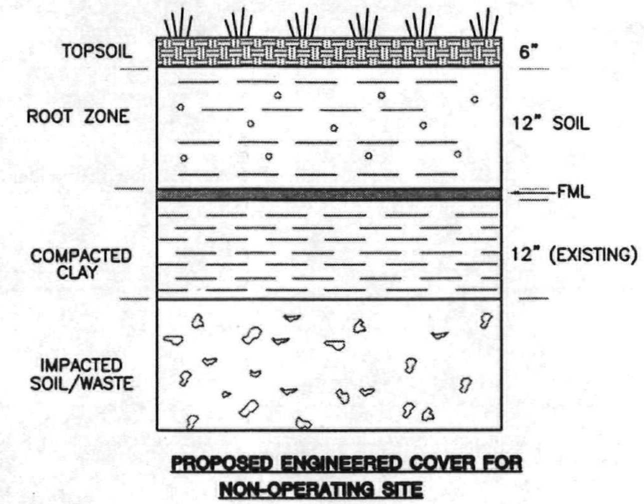
1252042
260101 8

**MONTGOMERY WATSON**

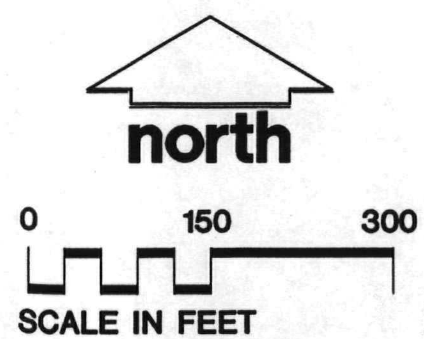



**PROPOSED ENGINEERED COVER FOR NON-OPERATING SITE**

**LEGEND:**

- LIMITS OF ENGINEERED COVER
- BARRIER WALL
- ENGINEERED COVER SURFACE ELEVATIONS
- INDICATES SURFACE WATER DISCHARGE FLOW DIRECTION
- ACCESS ROADS
- BWES TRENCH




**NOTES:**

1. ENGINEERED COVER FOR OPERATING SITE WILL BE EVALUATED DURING PRELIMINARY DESIGN, AND WILL BE BASED ON ACS FACILITIES OPERATING REQUIREMENTS

2. THE FOLLOWING DESIGN OBJECTIVES WILL BE USED FOR THE ENGINEERED COVER FOR OPERATING SITE:
   1. LIMIT FILTRATION
   2. ELIMINATE DIRECT CONTACT WITH CONTAMINATES
   3. PROVIDE SURFACE SEAL FOR ISVE SYSTEM
   4. ALLOW ACCESS FOR ACS OPERATING AS NECESSARY

**FIGURE 9**

**CONCEPTUAL CAP PLAN - STILL BOTTOMS POND AREA**

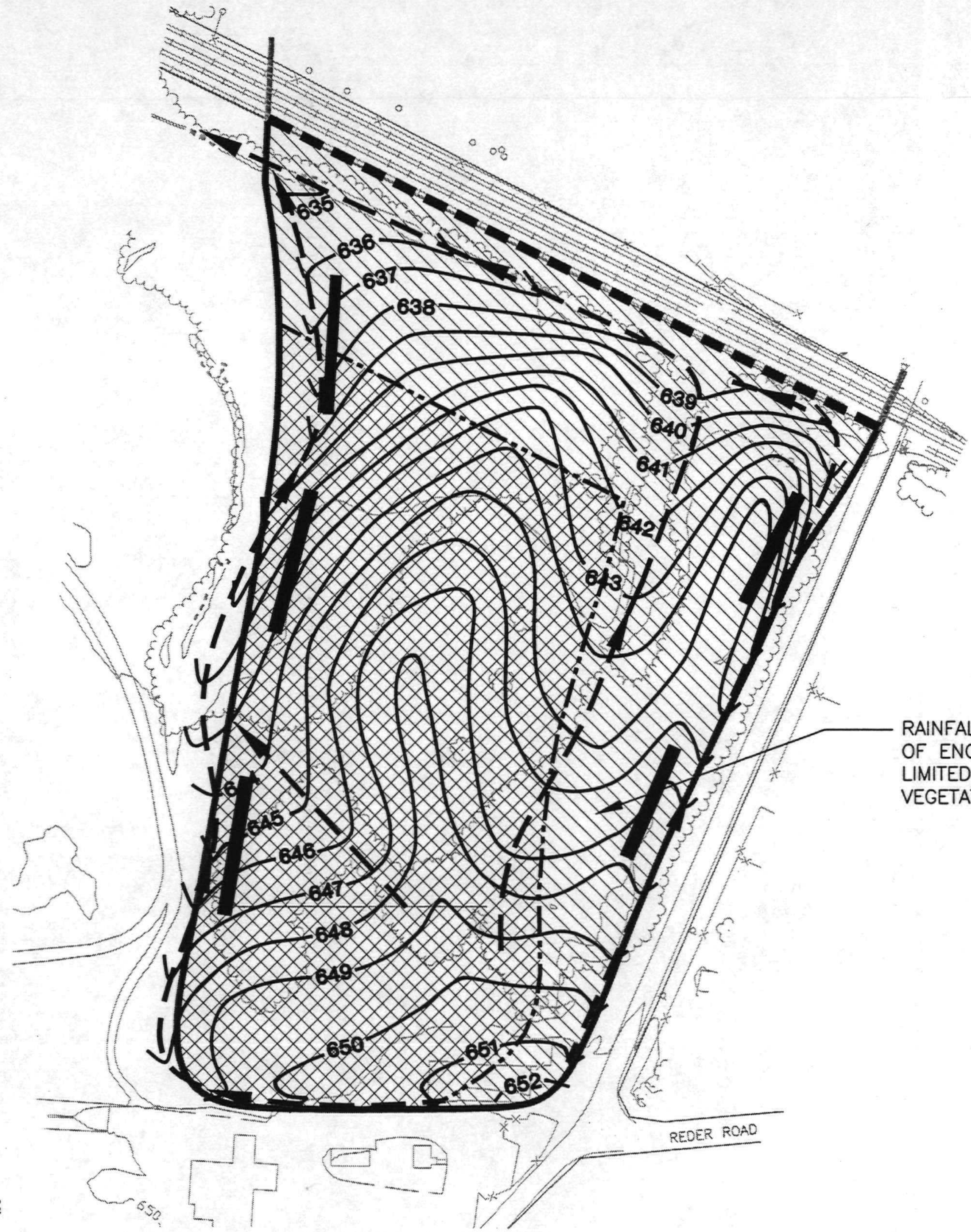
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

| | |
|---|---|
| Developed By BPG | Drawn By DKP |
| Approved By TAB | Date 8/6/98 |
| Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/X-SEC-POND.dwg | |
| Revisions | |

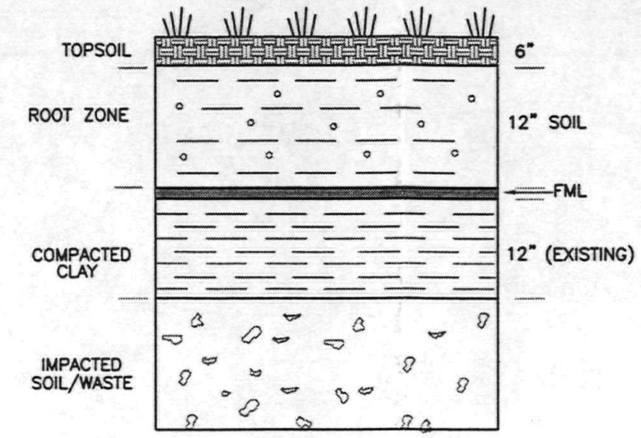
Drawing Number
1252042
260101 9

**MONTGOMERY WATSON**

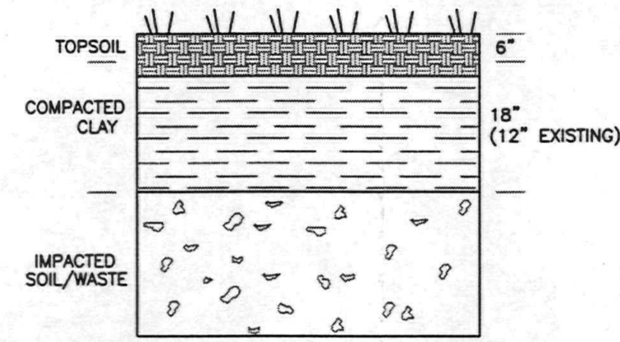
| QUALITY CONTROL | Graphic Standards | Technical Review | Management Review |
|---|---|---|---|
| | Lead Professional | Project Manager | Other |




RAINFALL INFILTRATION OUTSIDE OF ENGINEERED COVER WILL BE LIMITED BY GRADING AND VEGETATION



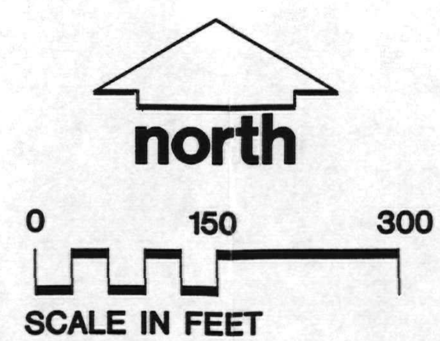

**PROPOSED ENGINEERED COVER FOR NON-OPERATING SITE**




**INTERIM COVER LIMITING RAINFALL INFILTRATION**

**LEGEND:**

- AREA TO LIMIT RAINFALL INFILTRATION
- LIMITS OF ENGINEERED COVER
- TRENCH
- PROPOSED SEPARATION BARRIER
- BARRIER WALL
- INDICATES SURFACE WATER DISCHARGE FLOW DIRECTION
- 652 ENGINEERED COVER SURFACE ELEVATIONS




| QUALITY CONTROL | |
|---|---|
| Graphic Standards | Lead Professional |
| Technical Review | Project Manager |
| Management Review | Other |



Developed By BPG
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Date 8/6/98
Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/X-SEC-OFFSITE.dwg
Revisions

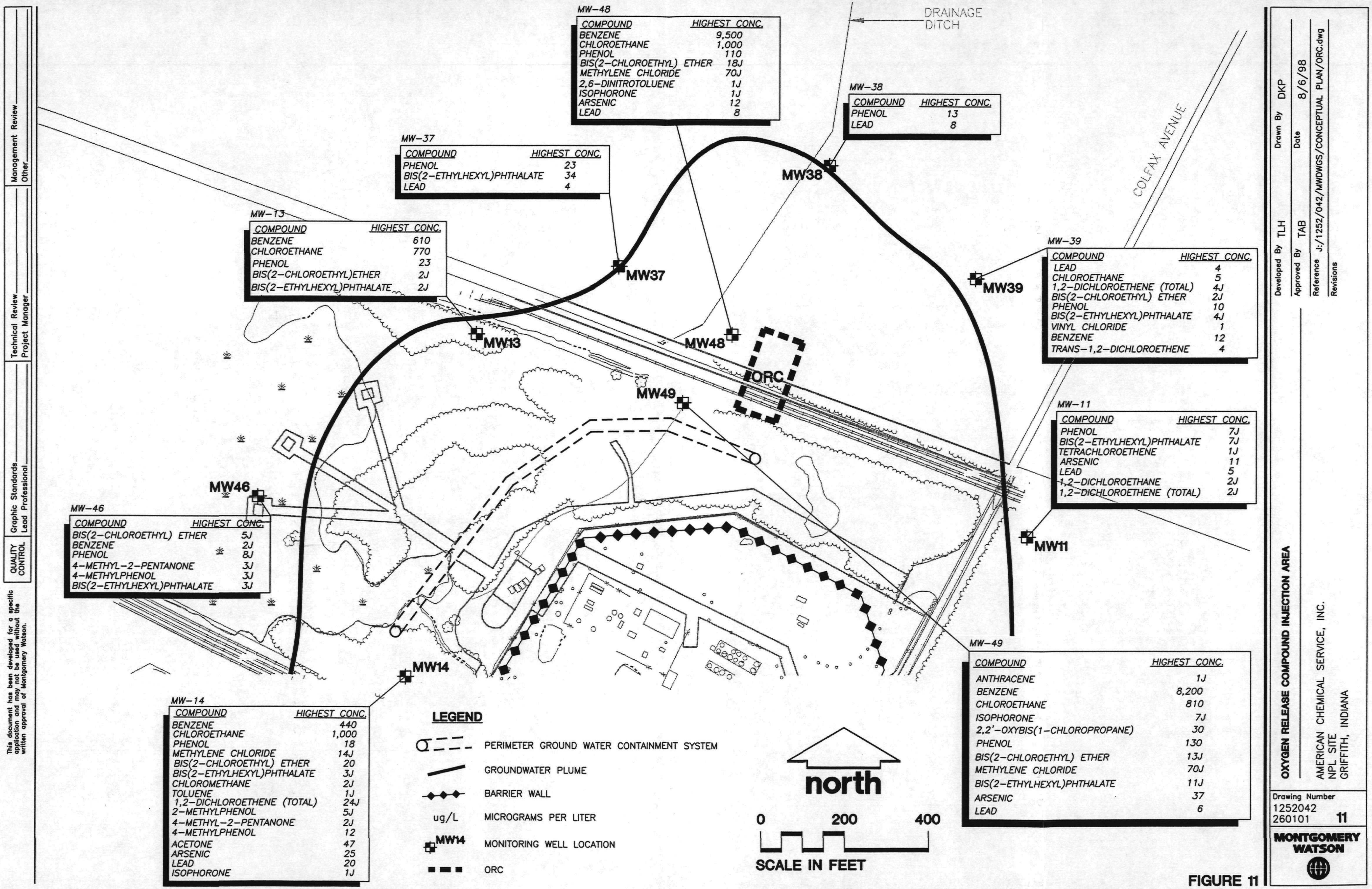
**CONCEPTUAL CAP PLAN - OFF-SITE CONTAINMENT AREA**

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
1252042
260101 10

**MONTGOMERY WATSON**

**FIGURE 10**



DRAINAGE DITCH
COLFAX AVENUE
MW-48
COMPOUND HIGHEST CONC.
BENZENE 9,500
CHLOROETHANE 1,000
PHENOL 110
BIS(2-CHLOROETHYL) ETHER 18J
METHYLENE CHLORIDE 70J
2,6-DINITROTOLUENE 1J
ISOPHORONE 1J
ARSENIC 12
LEAD 8
MW-38
COMPOUND HIGHEST CONC.
PHENOL 13
LEAD 8
MW-37
COMPOUND HIGHEST CONC.
PHENOL 23
BIS(2-ETHYLHEXYL)PHTHALATE 34
LEAD 4
MW-13
COMPOUND HIGHEST CONC.
BENZENE 610
CHLOROETHANE 770
PHENOL 23
BIS(2-CHLOROETHYL)ETHER 2J
BIS(2-ETHYLHEXYL)PHTHALATE 2J
MW-39
COMPOUND HIGHEST CONC.
LEAD 4
CHLOROETHANE 5
1,2-DICHLOROETHENE (TOTAL) 4J
BIS(2-CHLOROETHYL) ETHER 2J
PHENOL 10
BIS(2-ETHYLHEXYL)PHTHALATE 4J
VINYL CHLORIDE 1
BENZENE 12
TRANS-1,2-DICHLOROETHENE 4
MW-11
COMPOUND HIGHEST CONC.
PHENOL 7J
BIS(2-ETHYLHEXYL)PHTHALATE 7J
TETRACHLOROETHENE 1J
ARSENIC 11
LEAD 5
1,2-DICHLOROETHANE 2J
1,2-DICHLOROETHENE (TOTAL) 2J
MW38
MW37
MW39
MW13
MW48
ORC
MW49
MW46
MW11
MW14
MW-46
COMPOUND HIGHEST CONC.
BIS(2-CHLOROETHYL) ETHER 5J
BENZENE 2J
PHENOL 8J
4-METHYL-2-PENTANONE 3J
4-METHYLPHENOL 3J
BIS(2-ETHYLHEXYL)PHTHALATE 3J
MW-49
COMPOUND HIGHEST CONC.
ANTHRACENE 1J
BENZENE 8,200
CHLOROETHANE 810
ISOPHORONE 7J
2,2'-OXYBIS(1-CHLOROPROPANE) 30
PHENOL 130
BIS(2-CHLOROETHYL) ETHER 13J
METHYLENE CHLORIDE 70J
BIS(2-ETHYLHEXYL)PHTHALATE 11J
ARSENIC 37
LEAD 6
MW-14
COMPOUND HIGHEST CONC.
BENZENE 440
CHLOROETHANE 1,000
PHENOL 18
METHYLENE CHLORIDE 14J
BIS(2-CHLOROETHYL) ETHER 20
BIS(2-ETHYLHEXYL)PHTHALATE 3J
CHLOROMETHANE 2J
TOLUENE 1J
1,2-DICHLOROETHENE (TOTAL) 24J
2-METHYLPHENOL 5J
4-METHYL-2-PENTANONE 2J
4-METHYLPHENOL 12
ACETONE 47
ARSENIC 25
LEAD 20
ISOPHORONE 1J
LEGEND
PERIMETER GROUND WATER CONTAINMENT SYSTEM
GROUNDWATER PLUME
BARRIER WALL
ug/L MICROGRAMS PER LITER
MW14 MONITORING WELL LOCATION
ORC
north
0 200 400
SCALE IN FEET
QUALITY CONTROL
Graphic Standards
Lead Professional
Technical Review
Project Manager
Management Review
Other
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Drawn By DKP
Approved By TAB
Date 8/6/98
Reference J:/1252/042/MWDWGS/CONCEPTUAL PLAN/ORC.dwg
Revisions
OXYGEN RELEASE COMPOUND INJECTION AREA
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA
Drawing Number
1252042
260101 11
MONTGOMERY WATSON


FIGURE 11

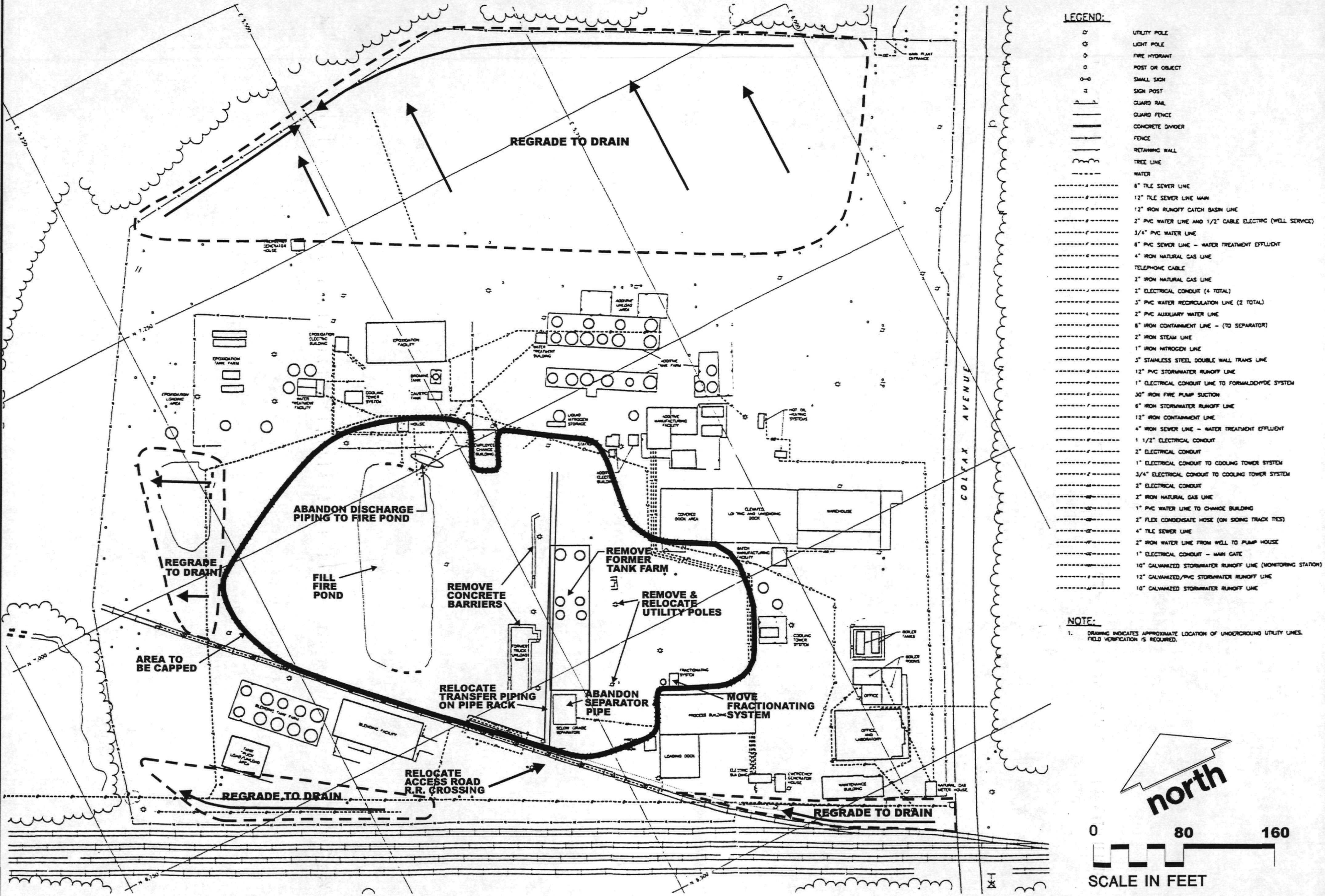



FIGURE 12

ACS FACILITY UTILITIES AND SITE PREPARATION

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Developed By TAB
Drawn By DKP
Approved By
Date 8/6/98
Reference J:/1252/042/MWDWGS/NORTH_SOUTH_CAP/STILL_BOTTOM.cdr
Revisions

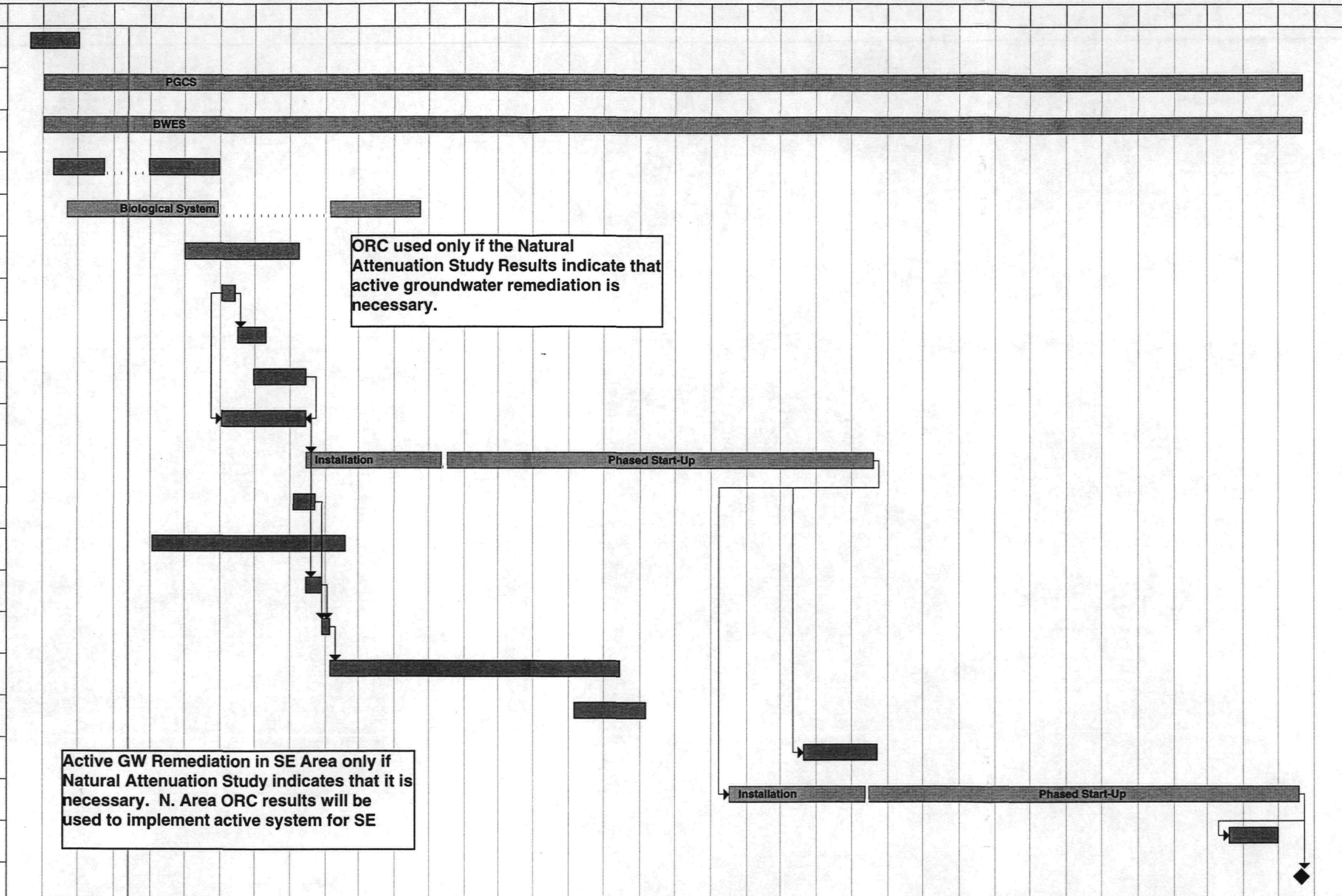
Drawing Number
1252042
260101 12

MONTGOMERY WATSON

QUALITY CONTROL
Graphic Standards
Lead Professional
Technical Review
Project Manager
Management Review
Other

# FIGURE 13: ACS Conceptual Sequence - Remedial Action

| ID | Task Name |
|---|---|
| 1 | Temporary Cover - Off-Site Area |
| 2 | Pump and Treat On-Site GW Outside Barrier Wall |
| 3 | Dewater GW inside Barrier Wall |
| 4 | ACS Stormwater Improvements |
| 5 | GWTP Upgrades |
| 6 | ORC Active Remediation - N. GW Plume |
| 7 | Wetlands Excavation |
| 8 | Spoils Pile Consolidation |
| 9 | On-Site Containment Area Drum Removal |
| 10 | Fill Fire Pond |
| 11 | ISVE-Off-Site Area |
| 12 | Separation Barrier |
| 13 | Site Prep -SBPA |
| 14 | Temporary Cover - SBPA |
| 15 | Well Points - SBPA |
| 16 | Dewater SBPA |
| 17 | Active Remediation - SE GW Plume |
| 18 | Final Cap - Off-Site |
| 19 | ISVE - SBPA |
| 20 | Final Cap - SBPA |
| 21 | Begin Long-Term O&M |




Project: 7_98_simple
Date: 8/13/98
7_98_simple

GW = Groundwater
ACS = American Chemical Service
GWTP = Groundwater Treatment Plant Upgrade
ORC = Oxygen Release Compound
ISVE = In-Situ Vapor Extraction
SBPA = Still Bottoms Pond Area
O&M = Operation & Maintenance

Task | Split | Progress | Milestone | Summary

## Appendix A - Contaminant Mass Calculations

Contents:

1. **Calculation Explanation**

2. **Tables :**

| Table Number | Description |
|---|---|
| 1a | Average Mass - Still Bottoms |
| 1b | Average Mass - Off-Site |
| 1c | Average Mass - K-P |
| 2a | Still Bottoms Total VOCs |
| 2b | Off-Site Area Total VOCs |
| 2c | K-P Area Total VOCs |
| 3 | Percentage of VOCs in Each Area |

3. **Surfer Plots:**

| Plot Number | Description |
|---|---|
| 1 | Total VOC Concentrations - 0-3 ft. |
| 2 | Total VOC Concentrations - 3-5 ft. |
| 3 | Total VOC Concentrations - 5-10 ft. |
| 4 | Total VOC Concentrations - 10-15 ft. |
| 5 | Total VOC Concentrations - 15-20 ft. |

4. **Cross Sections**

1 Off-Site Containment Area
2 Still Bottoms Pond Area
3 K-P Area

## Mass Calculation for ACS NPL Site

Calculation of Areal extent:

- Soil sample results from the Remedial Investigation and soils samples collected since were compiled into one database. The data was sorted into the three main areas:

| <u>Contaminant Area</u> | <u>Coordinates</u> |
|---|---|
| - Still Bottoms | (N6686 to N7166, E5268 to E5695) |
| - Off-Site Contaminant Area | (N5986 to N6343, E5083 to E5413) |
| - Kapica-Pazmey | (N5710 to N5915, E5023 to E5412) |

- The soil sample results were plotted by Surfer and maps were generated by the following depth intervals:

| | |
|---|---|
| - Still Bottoms: | 0-3 feet, 3-5 feet, 5-10 feet, 10-15 feet, 15-20 feet, and 20-25 feet (not provided). |
| - Off-Site Contaminant Area: | 0-5 feet, 5-10 feet, 10-15 feet, 15-20 feet, 20-25 feet (not provided), and 25-30 feet (not provided). |
| - Kapica-Pazmey: | 0-5 feet, 5-10 feet, 10-15 feet, 15-20 feet, and 20-25 feet (not provided). |

- A "dashed boundary" line was drawn on the attached surfer plots to indicate the areal extent of contamination. The areal extent was defined by soil sample results that were greater than 100 ppm. For example, sample results at locations next to each other had to be all less than 100 ppm to be outside the boundary. Conversely, if a sample with a concentration less than 100 ppm was surrounded by other samples with results greater than 100 ppm, the lower concentration sample location was included within the boundary.

- The volume of an area was calculated by assuming an approximate areal extent and multiplying by the depth of soil impacts. For example, in the Still Bottoms, the approximate size of the area is 450 feet diameter. The area is calculated as 159,043 square feet. The depth of the soil impacts are 25 feet, therefore the volume of impacted soil is 3,976,078 cubic feet. The volumes for the Still Bottoms area, Off-site area and Kapica-Pazmey are presented on Tables 1a, 1b, and 1c, respectively.

- Review of the soil borings within each depth interval shows that there are data gaps. For instance, soil samples may have been collected at a location in the 0-5 foot interval and in the 0-15 foot interval, but not in the 5-10 foot interval. It was reasonably assumed that if a contaminant was found at the upper and lower sample interval, the contaminant would be likely in the middle interval. Therefore, the volume was calculated by assuming the areal extent or "boundary" was consistent at each interval.

Calculation of Contaminant Mass

- The concentration of total volatile organic compounds (VOCs) for each sample was calculated by adding the concentration of individual contaminants and detection limits where applicable. For instance, some samples had elevated contaminant concentrations, causing detection limits for other individual contaminants to be raised by the laboratory and reported as non-detects. To be conservative, the concentrations of the non-detected compounds were set equal to the elevated detection limits in these samples.

- The average concentration within an interval was calculated by adding the total VOC concentrations of each sample within an area and depth interval and then dividing the sum by the total number of samples used for the summation. For example, in the sample interval of 0-3 feet in the Still Bottoms area, there where 6 locations were samples were collected; SB-091, SB-092, SB-093, SB-094, TP-05 and TP-07 (see Table 2a). The average for those six samples is 20,410 ppm. (See Table 1a). A list of the borings used for calculating the average concentration for the Still Bottoms, Off-site area and Kapica-Pazmey's intervals are presented in Tables 2a, 2b, and 2c, respectively and the averages are provided in Tables 1a, 1b, and 1c, respectively.

- The average concentration in each area is presented graphically by depth interval on the attached plan view surfer plots and the cross-sections.

- The average VOC mass was then calculated by multiplying the volume of the soil in each interval by the average concentration within that interval. A bulk soil density of sand at 100 lbs/cu. ft. was used. For example, in the interval of 0-3 feet for the Still Bottoms, the volume is 477,129 cubic feet and the average concentration is 20,410 ppm. The mass for that 3 foot thick interval is 973,803 pounds. (See Table 1a.) The mass for the Still Bottoms area, Off-site area and Kapica-Pazmey are presented on Tables 1a, 1b, and 1c, respectively.

  The total mass was determined by summing the average mass of each interval.

- The area which would be affected by SVE is the area above the water table. This area is assumed to be 3 to 5 feet below the current water table which is assumed to be achieved with the future dewatering plan. The future water table levels are anticipated to be:

- Still Bottoms — 10 feet below ground surface
- Off-Site Contaminant Area — 15 feet below ground surface

Therefore, the average mass where SVE would be applied is the sum of the mass above the future water table. For example, the average mass for the Still Bottoms would be 3,624,123 pounds. The average mass for the Still Bottoms area and the Off-site area that would be treated with SVE, are provided in Tables 1a and 1b, respectively.

Note that since the VOC mass of the Kapica-Pazmey area is approximately 3% of the total VOC mass and only 0.3% of the total soil mass within the Kapica-Pazmey, SVE is not considered a remedy for this area (See Table 3).

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# Table 1a Average Mass Still Bottoms

| z | Average (ppm) | Volume (cu. ft) | Average Mass (lbs) |
|---|---|---|---|
| 3 | 20,410 | 477,129 | 973,803 |
| 5 | 6,425 | 318,086 | 204,378 |
| 10 | 30,758 | 795,216 | 2,445,941 |
| 15 | 5,592 | 795,216 | 444,684 |
| 20 | 335 | 795,216 | 26,666 |
| 25 | 154 | 795,216 | 12,230 |
| **Total Average** | 10,331 | 3,976,078 | 4,107,703 |
| **Avg. @ 10 Feet** | 22,787 | | |

| | Volume | Mass |
|---|---|---|
| **Depth to 10 feet** | 1,590,431 | 3,624,123 |
| **Percent of total mass in Still Bottoms @ or Above 10 Feet.** | | 88.2% |

## Table 1b Average Mass Off-Site

| z | Average (ppm) | Volume (cu. ft.) | Average Mass (lbs) |
|---|---|---|---|
| 5 | 1,324 | 414,788 | 54,910 |
| 10 | 1,018 | 414,788 | 42,214 |
| 15 | 35,330 | 414,788 | 1,465,453 |
| 20 | 6,659 | 414,788 | 276,187 |
| 25 | 229 | 414,788 | 9,484 |
| 30 | 174 | 414,788 | 7,231 |
| **Total Average** | 7,455.54 | 2,488,728 | 1,855,480 |
| **Avg. @ 15 Feet** | 12,557 | | |

| | Volume | Mass |
|---|---|---|
| **Depth to 15 feet** | 1,244,364 | 1,562,577 |
| **Percent of total mass in Off-Site @ or Above 15 Feet.** | | 84.2% |

## Table 1c Average Mass Kapica-Pazmey

| z | Average (ppm) | Volume (cu. ft.) | Average Mass (lbs) |
|---|---|---|---|
| 5 | 4,452 | 385,000 | 171,406 |
| 10 | 1,062 | 385,000 | 40,880 |
| 15 | 2 | 385,000 | 66 |
| 25 | 0.31 | 385,000 | 12 |
| **Total Average** | 1,103 | 1,540,000 | 212,363 |
| **Avg. @ 15 Feet** | 1,839 | | |

| | Volume | Mass |
|---|---|---|
| **Depth to 15 feet** | 1,155,000 | 212,352 |
| **Percent of total mass in Off-Site @ or Above 15 Feet.** | | 99.99% |

Note: SB-030 was not included in the estimation of average mass because the area was excavated for the barrier wall and surrounding samples at the depth interval had low concentrations

Table 2a Still Bottoms Total VOC

| LOCATION | EAST | NORTH | SUM VOCs | Depth top | Depth bottom | z |
|---|---|---|---|---|---|---|
| SB-091 | 5280.09 | 6889.12 | 128.07 | 3 | 3 | 3 |
| SB-092 | 5367.35 | 6780.47 | 16487.4 | 3 | 3 | 3 |
| SB-093 | 5499.68 | 6685.66 | 8417 | 3 | 3 | 3 |
| SB-094 | 5661.57 | 6753.61 | 1996.3 | 3 | 3 | 3 |
| TP-05 | 5496.76 | 6955.22 | 48040 | 3 | 3 | 3 |
| TP-07 | 5545.19 | 6813.93 | 47389 | 3 | 3 | 3 |
| TP-06 | 5558.39 | 6761.24 | 30490 | 4 | 4 | 5 |
| SB-073 | 5429.86 | 6834.07 | 894.8 | 5 | 5 | 5 |
| SB-074 | 5449.01 | 6877.5 | 43.28 | 5 | 5 | 5 |
| SB-091 | 5280.09 | 6889.12 | 577.3 | 5 | 5 | 5 |
| SB-092 | 5367.35 | 6780.47 | 12.566 | 5 | 5 | 5 |
| SB-093 | 5499.68 | 6685.66 | 9704 | 5 | 5 | 5 |
| SB-094 | 5661.57 | 6753.61 | 3254.8 | 5 | 5 | 5 |
| SB-016 | 5468.79 | 6948.32 | 7310 | 6 | 6 | 10 |
| SB-118 | 5620.5 | 6721.5 | 73250 | 6 | 8 | 10 |
| SB-119 | 5567.4 | 6708.8 | 22968 | 6 | 8 | 10 |
| SB-017 | 5534.22 | 6747.9 | 8685 | 6.5 | 6.5 | 10 |
| SB-018 | 5575.58 | 6822.4 | 8097 | 7 | 7 | 10 |
| SB-020 | 5322.66 | 6942.54 | 76.495 | 7 | 7 | 10 |
| SB-021 | 5553.73 | 6950.64 | 0.443 | 7 | 7 | 10 |
| SB-110 | 5660.5 | 6751.9 | 259260 | 7 | 9 | 10 |
| SB-069 | 5545.1 | 6726.27 | 21446 | 8 | 8 | 10 |
| SB-070 | 5582.86 | 6719.7 | 7663.3 | 8 | 8 | 10 |
| SB-071 | 5620.11 | 6813.77 | 2086.2 | 8 | 8 | 10 |
| SB-072 | 5599.25 | 6873.15 | 37.76 | 8 | 8 | 10 |
| TP-04 | 5426.56 | 6889.23 | 2594.8 | 8 | 8 | 10 |
| TP-03 | 5402.4 | 6826.16 | 17140 | 9 | 9 | 10 |
| SB-014 | 5429.87 | 6817.52 | 75.66 | 11 | 11 | 15 |
| SB-021 | 5553.73 | 6950.64 | 39.635 | 12 | 12 | 15 |
| SB-022 | 5550.34 | 6780.1 | 8842.12 | 12 | 12 | 15 |
| SB-023 | 5556.59 | 6698.85 | 82.505 | 12 | 12 | 15 |
| SB-015 | 5462.63 | 6865.45 | 7180 | 13 | 13 | 15 |
| SB-075 | 5486.98 | 6937.64 | 17332 | 15 | 15 | 15 |
| SB-073 | 5429.86 | 6834.07 | 94.2 | 19 | 19 | 20 |
| SB-074 | 5449.01 | 6877.5 | 576.46 | 19 | 19 | 20 |
| SB-070 | 5582.86 | 6719.7 | 30.5 | 20.5 | 20.5 | 25 |
| SB-071 | 5620.11 | 6813.77 | 61.23 | 20.5 | 20.5 | 25 |
| SB-072 | 5599.25 | 6873.15 | 509 | 20.5 | 20.5 | 25 |
| SB-069 | 5545.1 | 6726.27 | 14.466 | 21.5 | 21.5 | 25 |

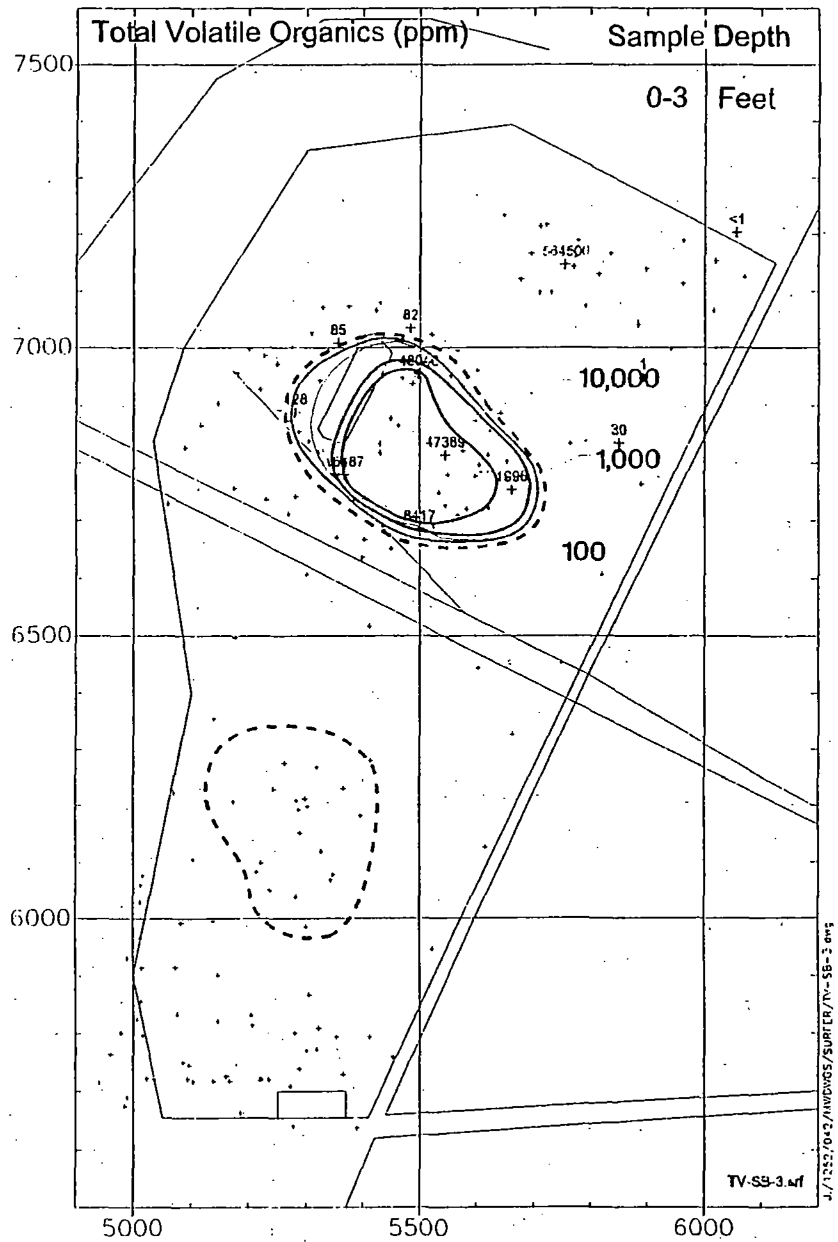
Table 2b Off-Site Total VOC

| LOCATION | EAST | NORTH | SUM VOCs | Depth top | Depth bottom | z |
|---|---|---|---|---|---|---|
| SA-01 | 5220 | 5720 | 81.806 | 0.5 | 1.5 | 5 |
| SA-02 | 5300 | 5770 | 1764.875 | 0.5 | 1.5 | 5 |
| SB-081 | 5268.26 | 6343.38 | 0.4962 | 4 | 4 | 5 |
| SB-082 | 5413.34 | 6280.41 | 5.1024 | 4.5 | 4.5 | 5 |
| SB-004 | 5221.47 | 6099.18 | 4766.8 | 5 | 5 | 5 |
| SB-079 | 5183.88 | 6101.94 | 0.5614 | 6 | 6 | 10 |
| SB-080 | 5126.02 | 6209.15 | 0.4667 | 6 | 6 | 10 |
| SB-081 | 5268.26 | 6343.38 | 0.7165 | 6 | 6 | 10 |
| SB-082 | 5413.34 | 6280.41 | 1.255 | 6.5 | 6.5 | 10 |
| SB-083 | 5394.79 | 6030.23 | 0.4102 | 6.5 | 6.5 | 10 |
| SB-079 | 5183.88 | 6101.94 | 0.4643 | 8 | 8 | 10 |
| SB-080 | 5126.02 | 6209.15 | 0.4838 | 8 | 8 | 10 |
| SB-036 | 5299.96 | 5986.36 | 87.78 | 10 | 10 | 10 |
| SB-037 | 5237.15 | 6051.48 | 419.45 | 10 | 10 | 10 |
| SB-038 | 5261.78 | 6275.34 | 5107 | 10 | 10 | 10 |
| SB-039 | 5173 | 6207.38 | 5576.5 | 10 | 10 | 10 |
| SB-083 | 5394.79 | 6030.23 | 198.8 | 10.5 | 10.5 | 15 |
| SB-025R | 5395.52 | 6182.29 | 2659.5 | 11 | 11 | 15 |
| SB-026R | 5289.38 | 6151.73 | 59665 | 11 | 11 | 15 |
| SB-027R | 5343.42 | 6068.63 | 4116.25 | 11 | 11 | 15 |
| SB-006 | 5325.93 | 6119.44 | 18133 | 11.5 | 11.5 | 15 |
| SB-003 | 5242.55 | 6229.09 | 3322.9 | 12 | 12 | 15 |
| SB-024R | 5318.2 | 6267.85 | 34820.05 | 12 | 12 | 15 |
| SB-005 | 5282.44 | 6039.4 | 3301.07 | 14 | 14 | 15 |
| SB-007 | 5366.43 | 6229.86 | 222730 | 14 | 14 | 15 |
| SB-006 | 5325.93 | 6119.44 | 4355 | 15 | 15 | 15 |
| SB-003 | 5242.55 | 6229.09 | 33741.25 | 17 | 17 | 20 |
| SB-005 | 5282.44 | 6039.4 | 62.27 | 17 | 17 | 20 |
| SB-037 | 5237.15 | 6051.48 | 5069.5 | 17 | 17 | 20 |
| SB-039 | 5173 | 6207.38 | 492.62 | 17 | 17 | 20 |
| SB-004A | 5212.68 | 6083.44 | 446.45 | 19 | 19 | 20 |
| SB-007 | 5366.43 | 6229.86 | 13135 | 19 | 19 | 20 |
| SB-003 | 5242.55 | 6229.09 | 60.28 | 20 | 20 | 20 |
| SB-038 | 5261.78 | 6275.34 | 260.8 | 20 | 20 | 20 |
| SB-024R | 5318.2 | 6267.85 | 634.92 | 21 | 21 | 25 |
| SB-025R | 5395.52 | 6182.29 | 13.302 | 21 | 21 | 25 |
| SB-026R | 5289.38 | 6151.73 | 33.61 | 21 | 21 | 25 |
| SB-027R | 5343.42 | 6068.63 | 62.67 | 21 | 21 | 25 |
| SB-037 | 5237.15 | 6051.48 | 13.836 | 23.5 | 23.5 | 25 |
| SB-038 | 5261.78 | 6275.34 | 771.23 | 23.5 | 23.5 | 25 |
| SB-039 | 5173 | 6207.38 | 43.04 | 23.5 | 23.5 | 25 |
| SB-027RR | 5346.91 | 6078.06 | 256.66 | 24 | 24 | 25 |
| SB-024R | 5318.2 | 6267.85 | 96.55 | 26 | 26 | 30 |
| SB-026R | 5289.38 | 6151.73 | 425.97 | 26 | 26 | 30 |
| SB-025R | 5395.52 | 6182.29 | 0.458 | 29 | 29 | 30 |

Table 2c K-P Total Vocs

| LOCATION | EAST | NORTH | SUM VOCs | Depth top | Depth botto | z |
|---|---|---|---|---|---|---|
| SB-001 | 5273.16 | 5710.15 | 31.83 | 3 | 3 | 5 |
| TP-01 | 5225 | 5750 | 60770 | 3.5 | 3.5 | 5 |
| SB-043 | 5365.56 | 5728.5 | 0.229 | 4.5 | 4.5 | 5 |
| SB-044 | 5352.84 | 5793.67 | 6140 | 4.5 | 4.5 | 5 |
| SB-045 | 5289.43 | 5738.93 | 31.14 | 4.5 | 4.5 | 5 |
| SB-046 | 5279.87 | 5801.45 | 197.241 | 4.5 | 4.5 | 5 |
| SB-047 | 5205.95 | 5814.14 | 213.969 | 4.5 | 4.5 | 5 |
| SB-048 | 5235.04 | 5720.95 | 216.54 | 4.5 | 4.5 | 5 |
| SB-049 | 5160.75 | 5726.03 | 0.268 | 4.5 | 4.5 | 5 |
| SB-050 | 5145.95 | 5821.15 | 0.658 | 4.5 | 4.5 | 5 |
| SB-051 | 5094.15 | 5721.8 | 3316 | 4.5 | 4.5 | 5 |
| SB-052 | 5076.06 | 5832.98 | 1.215 | 4.5 | 4.5 | 5 |
| SB-053 | 5005.94 | 5823.79 | 0.299 | 4.5 | 4.5 | 5 |
| SB-054 | 5022.58 | 5723.33 | 0.906 | 4.5 | 4.5 | 5 |
| SB-084 | 5305.16 | 5867 | 312.8 | 5 | 5 | 5 |
| SB-085 | 5411.88 | 5793.81 | 0.4038 | 5 | 5 | 5 |
| SB-002 | 5322.28 | 5808.58 | 904.7 | 5.5 | 5.5 | 10 |
| SB-041 | 5016.05 | 5796.61 | 0.256 | 5.5 | 5.5 | 10 |
| TP-01 | 5225 | 5750 | 0.322 | 6 | 6 | 10 |
| SB-087 | 5317.73 | 5771.86 | 0.4724 | 7 | 7 | 10 |
| SB-088 | 5138.92 | 5717.77 | 144.874 | 7.5 | 7.5 | 10 |
| SB-028 | 5146.05 | 5901.21 | 5529.2 | 8 | 8 | 10 |
| SB-029 | 5204.43 | 5831.57 | 588.98 | 8 | 8 | 10 |
| SB-002 | 5322.28 | 5808.58 | 0.334 | 8.5 | 8.5 | 10 |
| SB-001 | 5273.16 | 5710.15 | 0.31 | 9 | 9 | 10 |
| SB-030 | 5096.61 | 5745.08 | 664500 | 10 | 10 | 10 |
| SB-040 | 5072.57 | 5914.79 | 3448.8 | 10 | 10 | 10 |
| SB-088 | 5138.92 | 5717.77 | 0.555 | 10.5 | 10.5 | 15 |
| SB-087 | 5317.73 | 5771.86 | 2.857 | 11 | 11 | 15 |
| SB-041 | 5016.05 | 5796.61 | 0.31 | 23.5 | 23.5 | 25 |

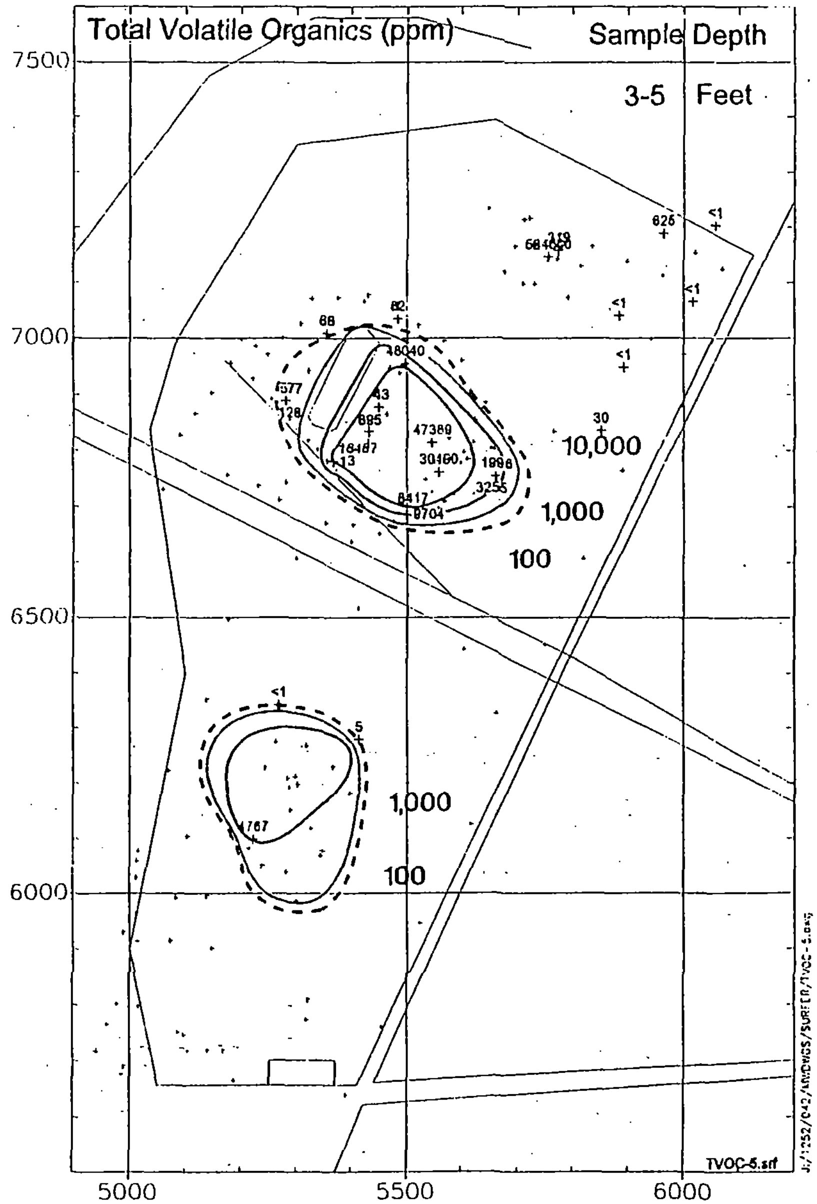
# Total VOC Concentrations (with nds)




LEGEND

APPOXIMATE LIMIT OF DETECTED TOTAL VOCs

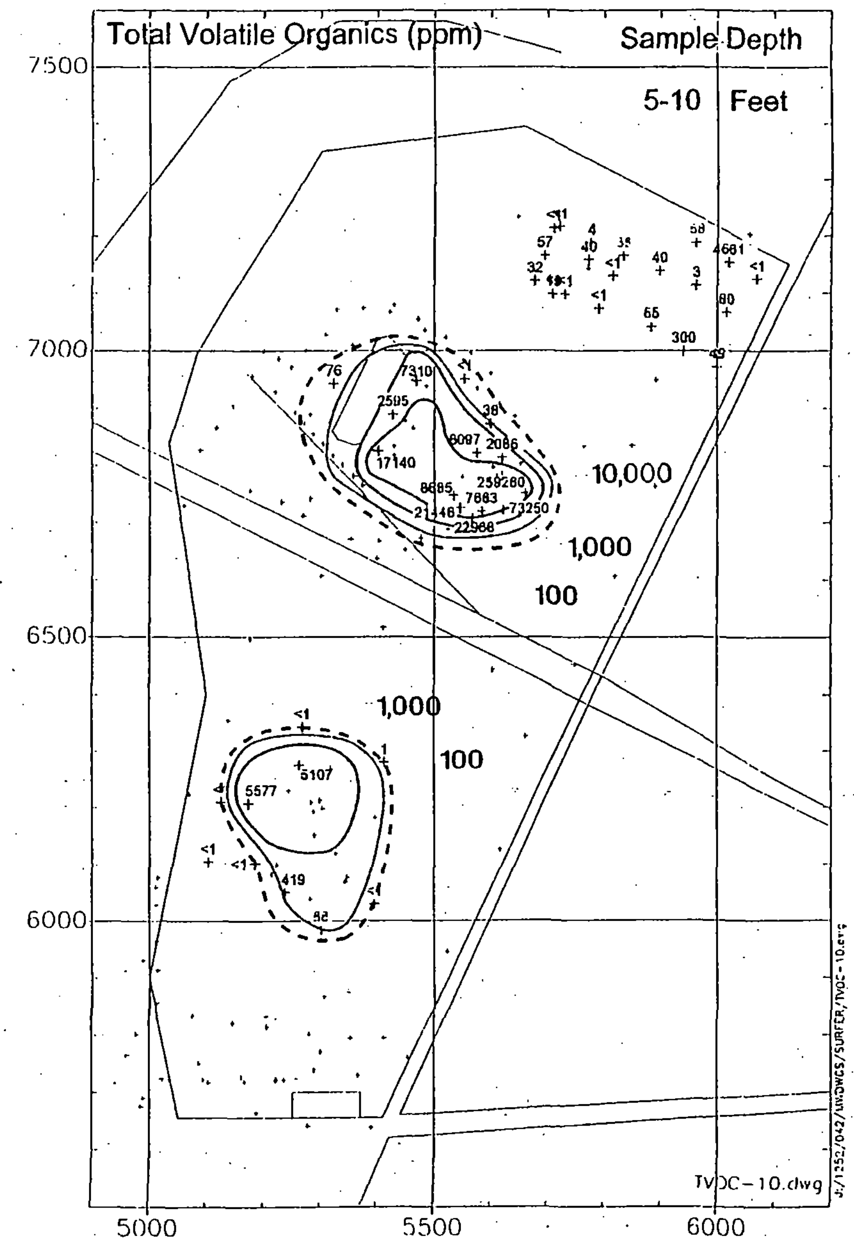
## Total VOC Concentrations (with nds)




LEGEND

APPOXIMATE LIMIT OF DETECTED TOTAL VOCs

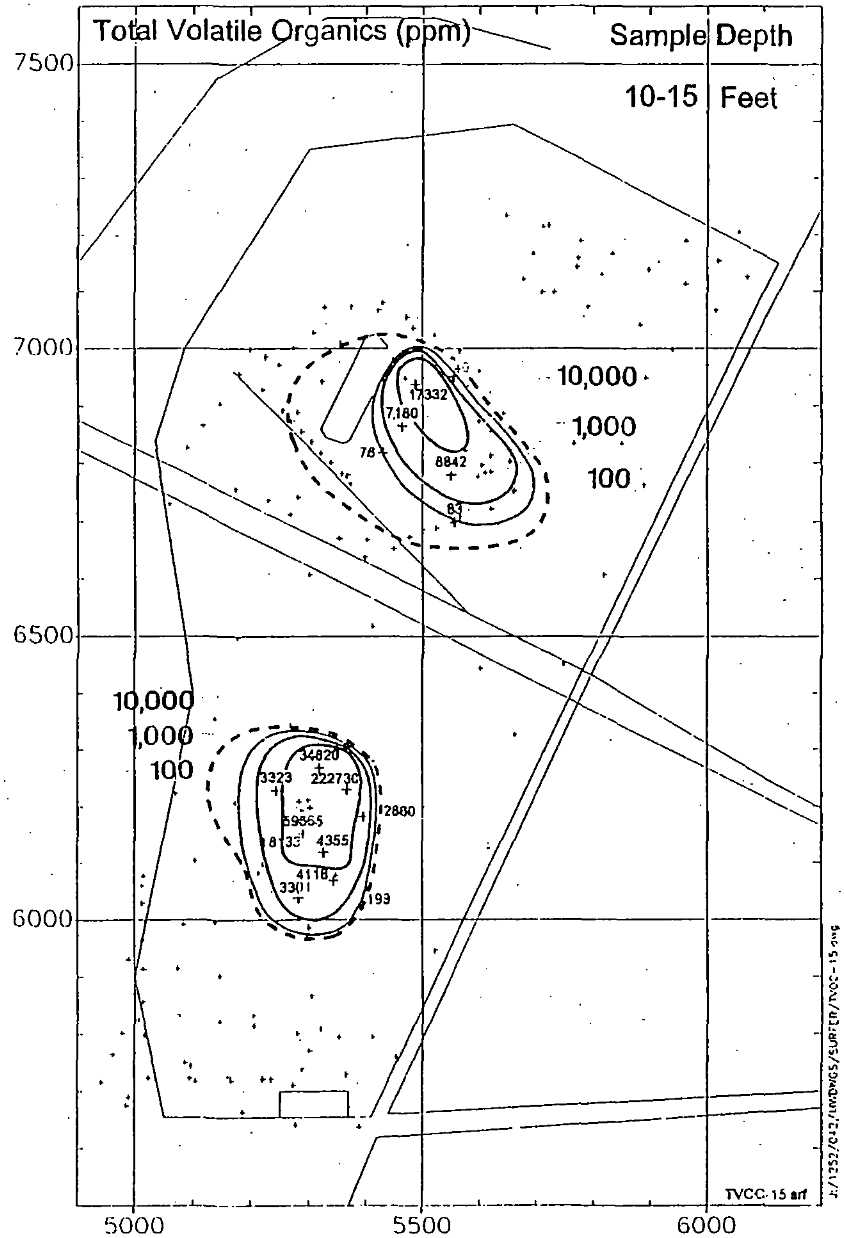
## Total VOC Concentrations (with nds)




LEGEND

APPOXIMATE LIMIT OF DETECTED TOTAL VOCs

# Total VOC Concentrations (with nds)

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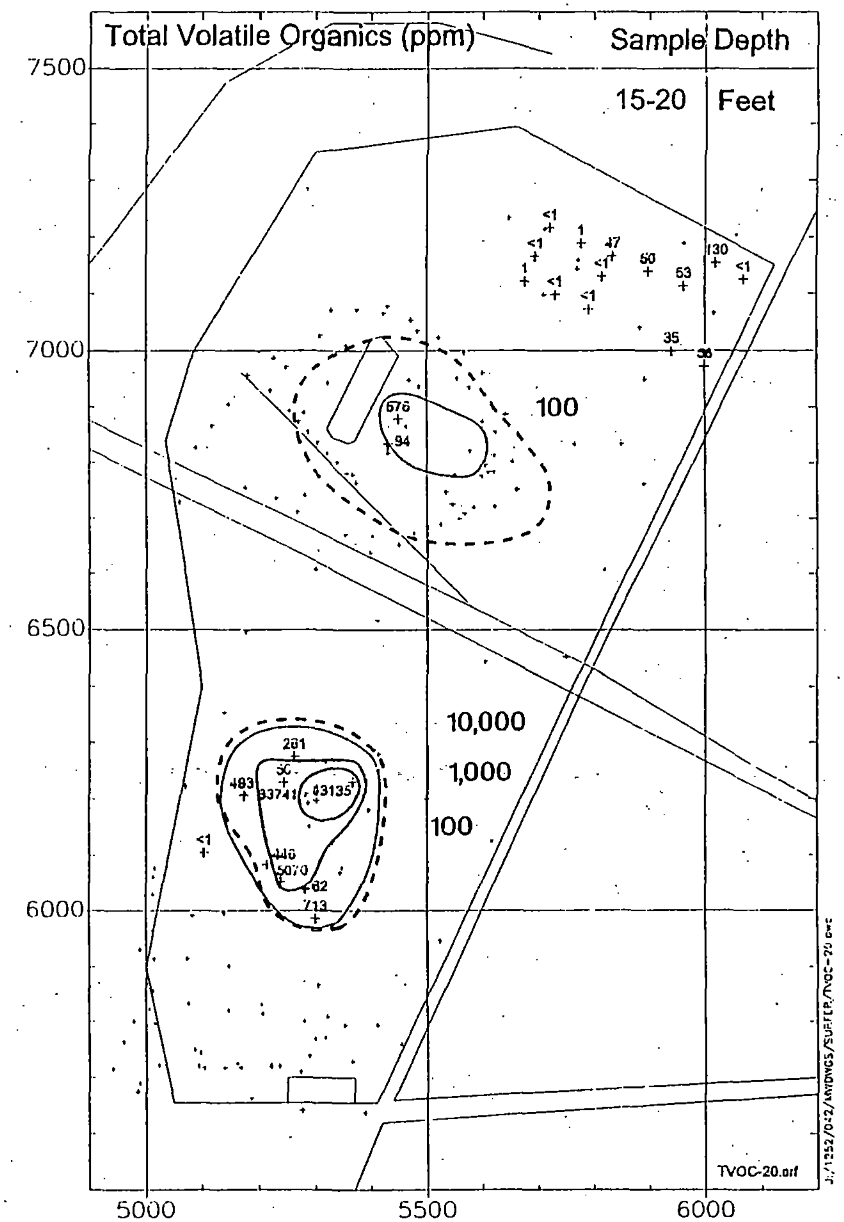
APPOXIMATE LIMIT OF DETECTED TOTAL VOCs

Total VOC Concentrations (with nds)

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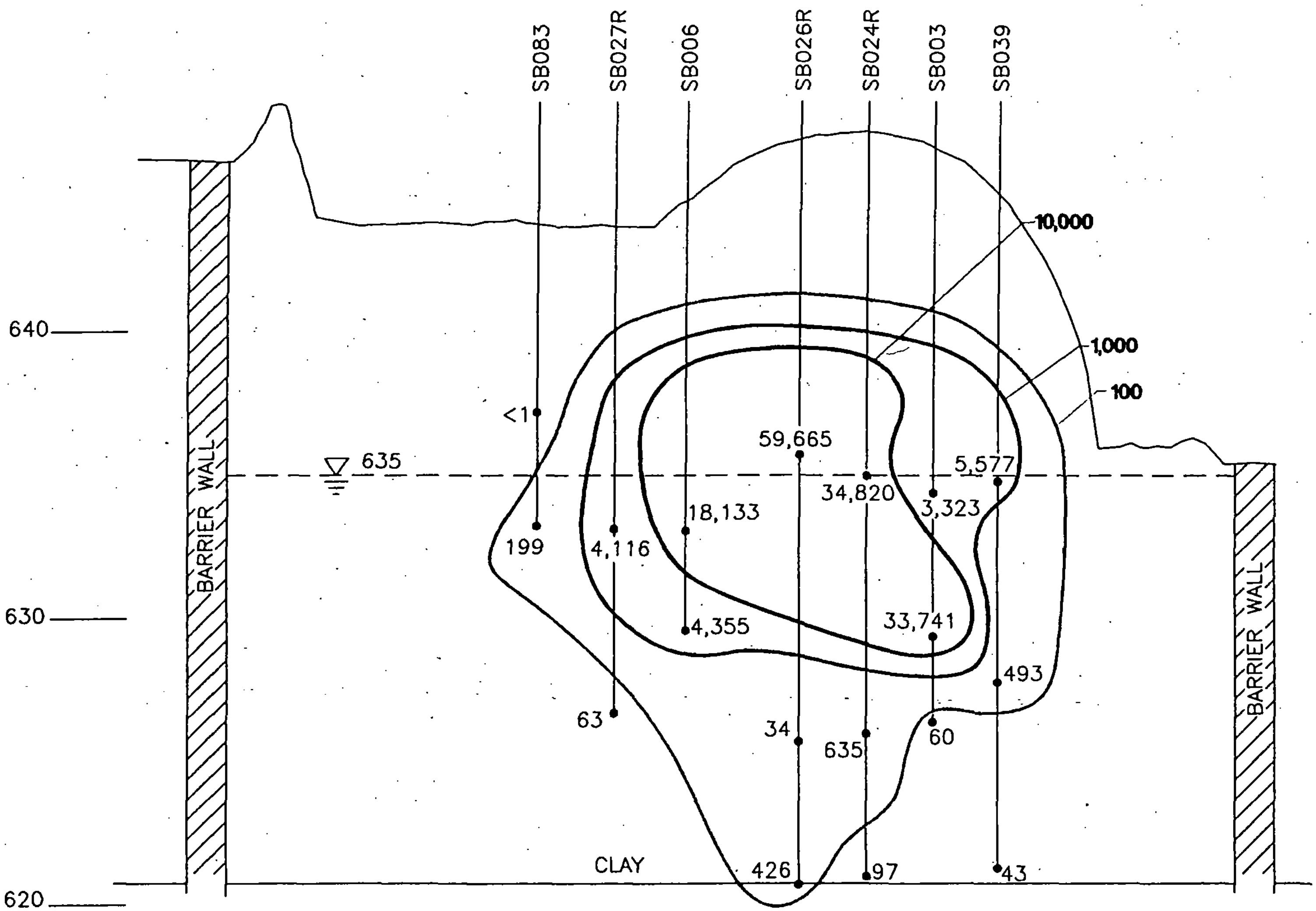
APPOXIMATE LIMIT OF DETECTED TOTAL VOCs




Off-Site Area Section - Looking South

**MONTGOMERY WATSON**
Chicago, Illinois

American Chemical Services NPL Site
Griffith, IN

# OFF-SITE CONTAINMENT AREA

SECTION 1

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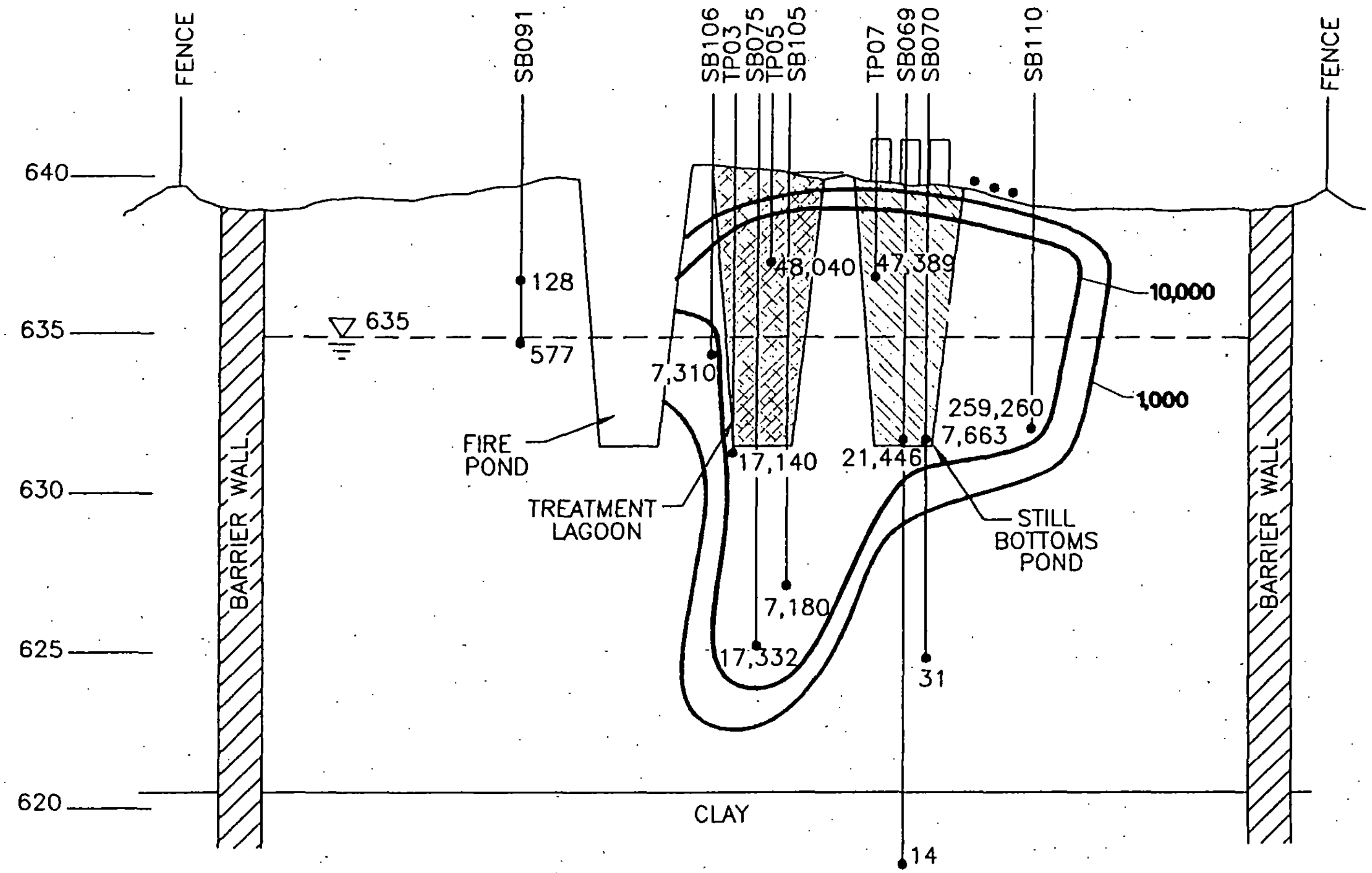


MONTGOMERY WATSON
Chicago, Illinois

American Chemical Services NPL Site
Griffith, IN

# STILL BOTTOMS POND AREA

SECTION 2

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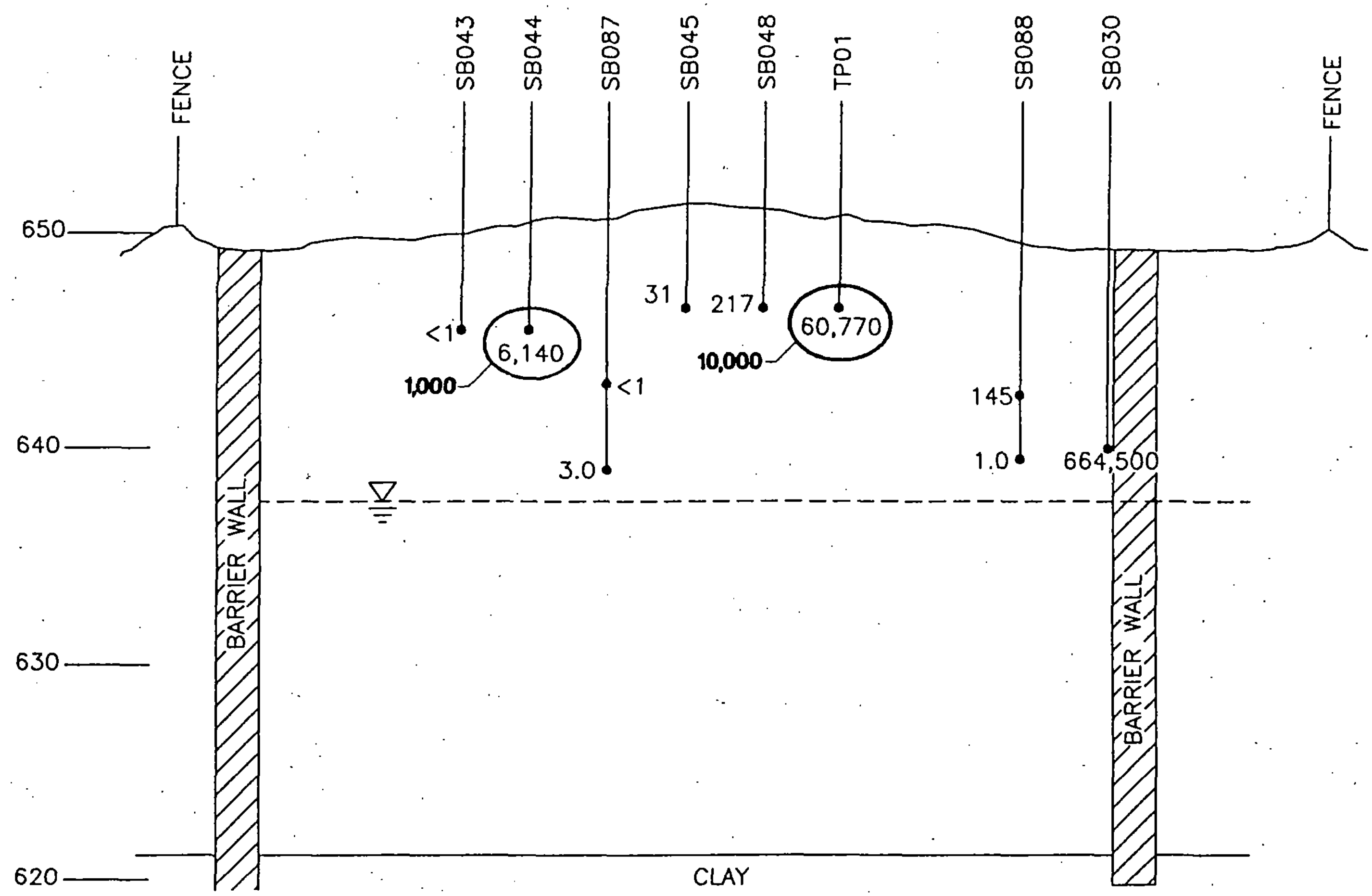


K-P Area Section - Looking South

MONTGOMERY WATSON
Chicago, Illinois

American Chemical Services NPL Site
Griffith, IN

K-P AREA

SECTION 3

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Table 3
Mass of Total VOC Contamination by Area

| | Areal Extent, acres | Contaminant Concentration, ppm | Mass of Total VOCs, lbs | |
|---|---|---|---|---|
| | | Average | Average | % of Total |
| Still Bottoms Area | 3.7 | 13,745 | 3,700,000 | 65% |
| Off-Site Area | 1.9 | 10,890 | 1,807,740 | 32% |
| K-P Area | 0.7 | 2,560 | 197,120 | 3% |
| | | | 5,704,860 | |

## Appendix B - ISVE Modeling Results

Contents:

1. **Modeling Explanation**

2. **Slides:**

| Slide Number | Description |
|---|---|
| 1 | Summary of Modeling Effort |
| 2 | Hyperventilate Modeling Inputs |
| 3 | Hyperventilate Modeling Outputs |
| 4 | Modeling Sensitivity Analysis |
| 5 | Conceptual ISVE Schematic |
| 6 | BioSVE Modeling - Percent Removed Over Time - Still Bottoms Pond Area |
| 7 | BioSVE Modeling - Percent Removed Over Time - Off-Site Containment Area |

3. **Off-Site Containment Area Modeling Results**

Hyperventilate Screen Output
BioSVE Output @ 1.75 Darcy's
@ 5.2 Darcy's
@ 10 Darcy's

4. **Still Bottoms Pond Area Modeling Results**

Hyperventilate Screen Output
BioSVE Output @ 1.75 Darcy's
@ 5.2 Darcy's
@ 10 Darcy's

# Modeling for ISVE
# ACS NPL Site

Modeling

- Two screening models, acceptable to the EPA, were used: Hyperventilate and BioSVE. These models only answer the question: "Is SVE feasible?" The equations upon which the models are based are simplistic and provide "ideal" mass removal (Johnson et. al and Johnson et. al). Because the models are simple, neither model predicts accurate mass removal after initial startup. (See Slide 1).

- Hyperventilate provides a check for the conceptual design, gives achievable vapor flows based on the soil type and permeability, and desired mass removal for a given time frame.

- The input parameters (See Slide 2) used for the Hyperventilate modeling effort were:
  - Soil permeability (based on site hydraulic conductivity, the soil's air permeability is 1.75 to 10 darcys)
  - Radius of influence (30 feet is typical and conservative for sand according to the hyperventilate manual)
  - Screen interval (5 feet in Still Bottoms, 10 feet in Off-site based on the proposed dewatering plan)
  - Well size (4 inch diameter - typical according to hyperventilate manual)
  - Remediation time (10 - 15 years considered reasonable)

- Hyperventilate outputs for both the Still Bottoms and Off-site are presented on Slide 3.

- A sensitivity analysis of the Hyperventilate model is presented on Slide 4. The information is based on the user manual and several model runs with differing inputs.

- A typical schematic for an SVE system is presented on Slide 5. The system generally consists of extraction wells or trenches, conveyance piping, a condensate tank, a blower and stack. Typically, off-gas treatment is required at the stack. (See Slide 5).

- BioSVE provided a time rate of removal, which will determine if and how much of the mass can be removed in the time interval of 10 to 15 years based on the individual contaminants that make up the total mass of VOCs. (See Slide 1).

- The input parameters for BioSVE were calculated in Hyperventilate. The limitations of the model include an upper bound on the total mass of contaminant that can be modeled. Therefore, the total VOC mass was divided by the number of wells anticipated for each area (from Hyperventilate) and BioSVE was modeled using the mass per well. The modeled output (percent mass removal), although it was determined based on the mass from one well, would apply to the entire site. The input parameters were:

  - Mass per well (total mass divided by number of wells)
  - Flowrate (from Hyperventilate - varies by area and permeability)
  - Time frame (15 years)
  - Area (total area divided by number of wells)
  - All other outputs were model defaults

- The output of BioSVE model is presented as a percentage of initial mass (See Slides 6 and 7).

REFERENCES

Johnson, P.C., C.C. Stanley, M.W. Kemblowski, Dl Byers and J.D. Colthart, 1990. A Practical Approach to the Design Operation, and Monitoring of In-Situ Soil-Venting Systems, GWMR Spring 1990.

Johnson, P.C., M.W. Kemblowski, and J.D. Colthart, 1990. Quantitative Analysis for the Cleanup of Hydrocarbon - Contaminated Soil by In-Situ Soil Venting, Groundwater Vol. 28 No. 3 May June 1990.

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# Summary of Modeling Effort

Two Models used as Screening Tools - Hyperventilate and Venting (BioSVE) - Both referenced by U.S. EPA

- Idealized models, predict maximum amounts, and don't account for subsurface dry-out and "crusting"

- <u>Hyperventilate -</u>
  - Can the mass be SVE'd effectively?
  - Will the Soil allow Adequate Flow?
    - Provides a check for conceptual design, gives required flow and achievable flows, but not time rate of removal.
- <u>Venting (BioSVE) -</u>
  - How easily are contaminants released?
  - Over what time frame will contaminants be released?
    - Uses achievable flows from Hyperventilate, gives time rate of removal

# Hyperventilate Modeling Inputs

| | |
|---|---|
| • Permeability, darcys | 1.75 to 5.2 to 10 (silty sand to sand/debris to debris) |
| • ROI | 30 ft (60 ft. well spacing) |
| • Screen Interval | 5 ft (Still Btms), 10 ft (Off-Site) |
| • Vacuum | 60" (Still Btms), 120" (Off-Site) |
| • Well Size | 8" borehole, 4" pipe |
| • Remediation Time | 10 - 15 yrs |
| • Depth of Water Table | 8 - 10 ft (Still Bottoms)<br>12-15 ft (Off-Site) |

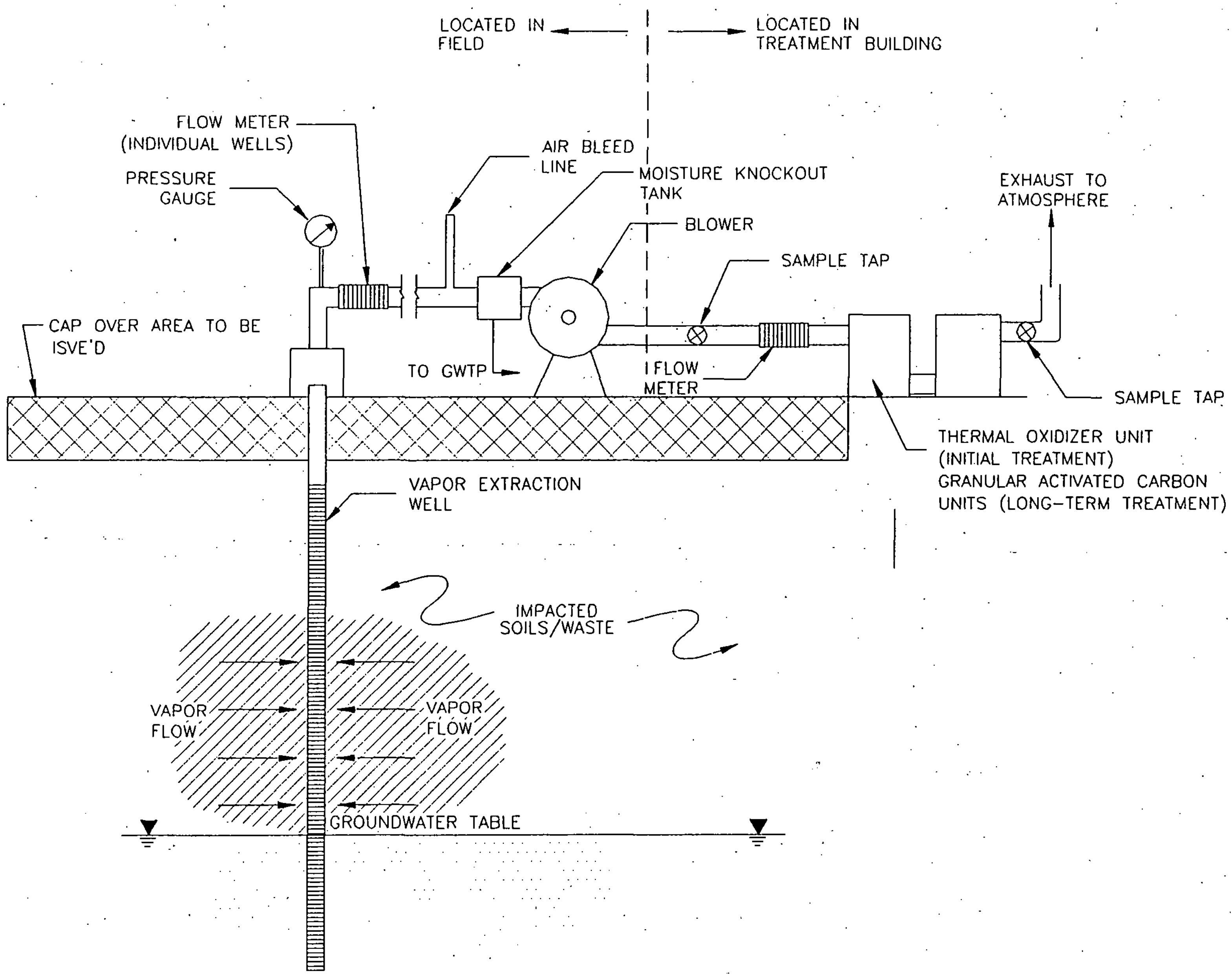
# Hyperventilate Model Outputs

| | |
|---|---|
| • Required Rate of Removal | 490 to 990 lb/day |
| • Achievable Rate of Removal | 320 to 2970 lb/day |
| • Number of Wells Req'd | 56 (Still Bottoms) |
| | 29 (Off-Site) |
| • Initial Vapor Conc. (ppm) | 400 - 600 ppm |
| • Efficiency | 70 - 85% |

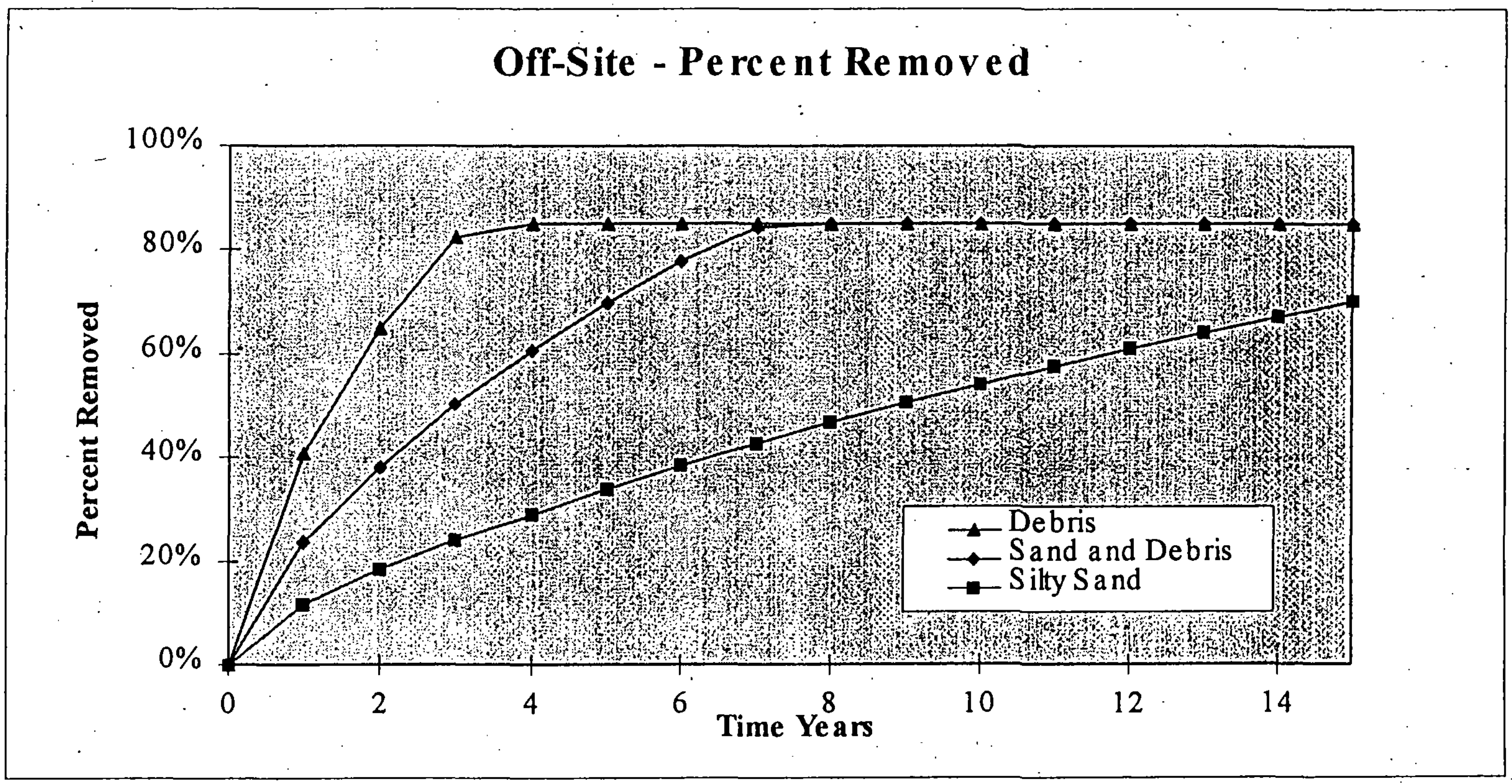
# Modeling Sensitivity Analysis

| | |
|---|---|
| • Permeability | 1 to 1 Effect |
| • Well Radius | 16% increase in flow for doubling size |
| • ROI | 16% decrease in flow for doubling size |
| • Screen Length | 1 to 1 Effect |
| • Vacuum | 1 to 1 Effect below 120 in vacuum |
| • Time | Inversely proportional to desired removal rate |

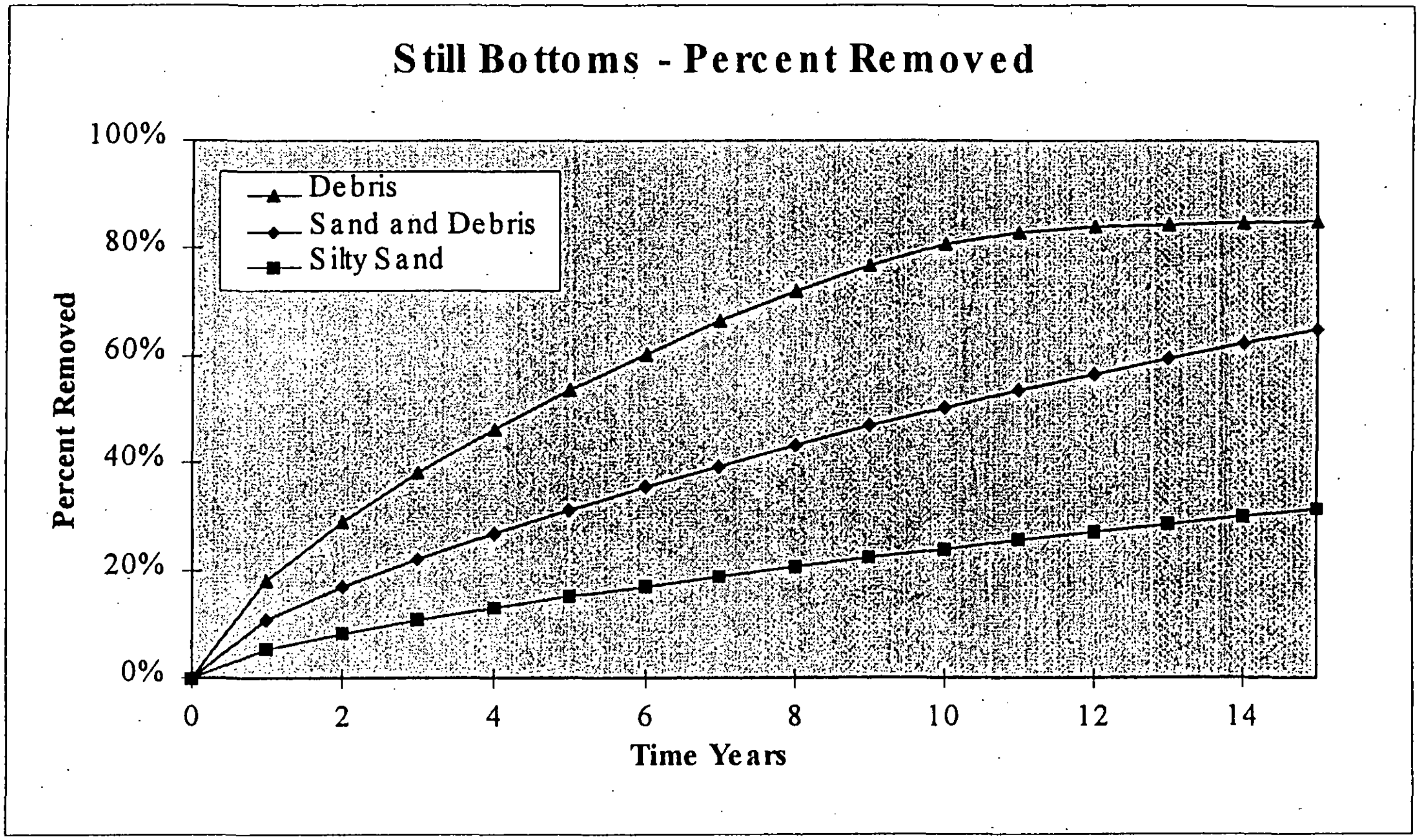
# Conceptual ISVE Schematic



# BioSVE Modeling - Percent Removed Over Time



# BioSVE Modeling - Percent Removed Over Time



## lowrate Estimation:

- ○ Medium Sand
- ○ Fine Sand
- ○ Silty Sand
- ○ Clayey Silts
- ◉ Input Your Own Permeability Range

1) Choose Soil Type, or
   Optional - Enter your own permeability values (darcy)
2) Enter Well Radius (in)
3) Enter Radius of Influence (ft) & Interval Thickness*
4) Optional - Enter your own well vacuum (406" = max)
5) Click button to calculate Predicted Flowrate Ranges

**Permeability Range (darcy)**

1.75 to 5.2

**Well Radius** 2 in

**Radius of Influence** 30 ft

**Interval Thickness*** 10 ft

**-->Calculate Flowrate Ranges<--**

*thickness of screened interval, or permeable zone (whichever is smaller).

**Predicted Flowrate Ranges**

| Well Vacuum $P_w$ (in $H_2O$) | Flowrate (SCFM) (single well) 1.75 darcy | | 5.2 darcy |
|---|---|---|---|
| 5 | 0.93 | to | 2.76 |
| 10 | 1.84 | to | 5.48 |
| 20 | 3.64 | to | 10.83 |
| 40 | 7.10 | to | 21.11 |
| 60 | 10.38 | to | 30.84 |
| 120 | 19.11 | to | 56.77 |
| 4 108 | 17.49 | to | 51.98 |

OFFSITE

About Soils (& Unit Conversions) 8 Info about Calculation

## Flowrate Estimation:

- ○ Medium Sand
- ○ Fine Sand
- ○ Silty Sand
- ○ Clayey Silts
- ◉ Input Your Own Permeability Range

**Permeability Range (darcy)**

1.75 to 10

| | | |
|---|---|---|
| **Well Radius** | 2 | in |
| **Radius of Influence** | 30 | ft |
| **Interval Thickness*** | 10 | ft |

**-->Calculate Flowrate Ranges<--**

* thickness of screened interval, or permeable zone (whichever is smaller).

1) Choose Soil Type, or
Optional - Enter your own permeability values (darcy)
2) Enter Well Radius (in)
3) Enter Radius of Influence (ft) & Interval Thickness*
4) Optional - Enter your own well vacuum (406" = max)
5) Click button to calculate Predicted Flowrate Ranges

**Predicted Flowrate Ranges**

| Well Vacuum $P_w$ (in $H_2O$) | Flowrate (SCFM) (single well) 1.75 darcy | | 10 darcy |
|---|---|---|---|
| 5 | 0.93 | to | 5.30 |
| 10 | 1.84 | to | 10.54 |
| 20 | 3.64 | to | 20.82 |
| 40 | 7.10 | to | 40.59 |
| 60 | 10.38 | to | 59.31 |
| 120 | 19.11 | to | 109.17 |
| 108 | 17.49 | to | 99.95 |

4

About Soils (& Unit Conversions) | 8 | Info about Calculation

## Vapor Concentration Estimation - Calculation

1. Type in Temperature (C) (hit <return>) — 20

2. *Click to Enter Composition of Contaminant* or Choose one of the Default Distributions
   - ◉ *Enter Distribution*
   - ○ "Fresh" Gasoline
   - ○ "Weathered" Gasoline

3. Click to View Distributions. (optional) — View Distributions

4. Click to Perform Calculations — ◉ Perform Calculations

**Results:**

| | | |
|---|---|---|
| Sum of Mass Fractions | 1.01900 | |
| Calc. Vapor Pressure | 0.12642 | atm |
| Calc. Vapor Concentration | 409.59751 | mg/l |

How Do I Measure a Distribution? | 10 | About Calculation | Print Card

## *Maximum Removal Rate Estimates*

elect your unit preference below

◉ [lb/d]

○ [kg/d]

Note:

hese are "maximum removal rates", and should only be used as screening estimates to determine venting is even feasible at a given site. Continue on to the next card to assess if these rates are acceptable...

| | |
|---|---|
| Temperature (C) | 20 |
| Soil Type | User Defined |
| Soil Permeability Range (darcy) | 1.75 to 5.2 |
| Well Radius (in) | 2 |
| Radius of Influence (ft) | 30 |
| Contaminant Type | User Defined |
| Permeable Zone Thickness (ft) | 10 |

| $P_w$ - Well Vacuum (in $H_2O$) | Flowrate Estimates [SCFM] (single well) | | | Max. Removal Rate Estimates [lb/d] (single well) | | |
|---|---|---|---|---|---|---|
| 5 | 0.93 | to | 2.76 | 34.72 | to | 103.04 |
| 10 | 1.84 | to | 5.48 | 69.56 | to | 207.16 |
| 20 | 3.64 | to | 10.83 | 141.16 | to | 419.99 |
| 40 | 7.10 | to | 21.11 | 290.35 | to | 863.29 |
| 60 | 10.38 | to | 30.84 | 448.97 | to | 1333.92 |
| 120 | 19.11 | to | 56.77 | 999.49 | to | 2969.17 |
| 108 | 17.49 | to | 51.98 | 878.02 | to | 2609.46 |

12

Print Card

## *Maximum Removal Rate Estimates*

| | | | |
|---|---|---|---|
| Temperature (C) | 20 | | |
| Soil Type | User Defined | | |
| Soil Permeability Range (darcy) | 1.75 | to | 5.2 |
| Well Radius (in) | 2 | | |
| Radius of Influence (ft) | 30 | | |
| Contaminant Type | User Defined | | |
| Permeable Zone Thickness (ft) | 10 | | |

elect your unit preference below

◉ [lb/d]

○ [kg/d]

Note:

hese are "maximum removal rates", and should only be used as screening estimates to determine venting is even feasible at a given site. Continue on to the next card to assess if these rates are cceptable...

| $P_w$ - Well Vacuum (in $H_2O$) | Flowrate Estimates [SCFM] (single well) | | | Max. Removal Rate Estimates [lb/d] (single well) | | |
|---|---|---|---|---|---|---|
| 5 | 0.93 | to | 2.76 | 34.72 | to | 103.04 |
| 10 | 1.84 | to | 5.48 | 69.56 | to | 207.16 |
| 20 | 3.64 | to | 10.83 | 141.16 | to | 419.99 |
| 40 | 7.10 | to | 21.11 | 290.35 | to | 863.29 |
| 60 | 10.38 | to | 30.84 | 448.97 | to | 1333.92 |
| 120 | 19.11 | to | 56.77 | 999.49 | to | 2969.17 |
| 108 | 17.49 | to | 51.98 | 878.02 | to | 2609.46 |

12

Print Card

## *Is Soil Venting Appropriate?*

At this point, you compare the maximum possible removal rate with your desired removal rate.

If the maximum removal rate does not exceed your desired removal rate, then soil venting is not likely to meet your needs, and you should consider another treatment technology, or make your needs more realistic.

In the next cards, we will refine the removal rate estimates, in order to decide if venting can achieve your objectives.

① Enter Estimated Spill Mass: 1800000 ○ kg ◉ lb

② Enter Desired Remediation Time: 3650 days

③ -->Press to get Rates<--

**Single Vertical Well Results**

| | | |
|---|---|---|
| Desired Removal Rate: | 493.150 | [lb/d] |
| Gauge Vacuum (in H2O): | 120 | [in H2O] |
| Min Flowrate @ 120in H2O | 19.11 | [SCFM] |
| Max Flowrate @ 120in H2O | 56.77 | [SCFM] |
| Max. Est. Removal Rate: | | |
| (lower estimate) - per well | 999.49 | [lb/d] |
| (upper estimate) - per well | 2969.17 | [lb/d] |

13

① -> Import Data <-

FIRST PRESS THE IMPORT DATA BUTTON!

These are the results for the contaminant type that you have specified. All of this

Saturated Vapor Concentration at time=0 | .4096E+03 | [mg/L]

Min Volume to Remove >90% of Initial Residual | 12.95 | [L-air/g-residual]

Temperature (oC): 20

Contaminant Type: User Defined

| Qt/M(0) L-air/ g-residual | Vapor Conc. [% Initial] | Residual Level [% Initial] | BP #1 Residual [% total] | BP #2 Residual [% total] | BP #3 Residual [% total] | BP #4 Residual [% total] | BP #5 Residual [% total] |
|---|---|---|---|---|---|---|---|
| 8.69 | 11.93 | 28.10 | .00 | .00 | 1.07 | 7.51 | 91.41 |
| 9.71 | 11.50 | 23.10 | .00 | .00 | .38 | 6.31 | 93.31 |
| 10.77 | 11.25 | 18.10 | .00 | .00 | .05 | 5.22 | 94.73 |
| 11.86 | 11.16 | 13.10 | .00 | .00 | .00 | 4.24 | 95.76 |
| 12.95 | 11.17 | 8.10 | .00 | .00 | .00 | 3.25 | 96.75 |
| 14.05 | 11.21 | 3.10 | .00 | .00 | .00 | 1.27 | 98.73 |
| 14.08 | 11.21 | 2.94 | .00 | .00 | .00 | 1.25 | 98.75 |
| 14.11 | 11.21 | 2.80 | .00 | .00 | .00 | 1.22 | 98.78 |



Print Card

# *Is Venting Appropriate?*

This is a complete summary of the data and results. Based upon these numbers, a "minimum number of wells" has been calculated, which should give you some indication of how appropriate venting is for your application. Note that this is the number of wells if circumstances are ideal, which they rarely are.

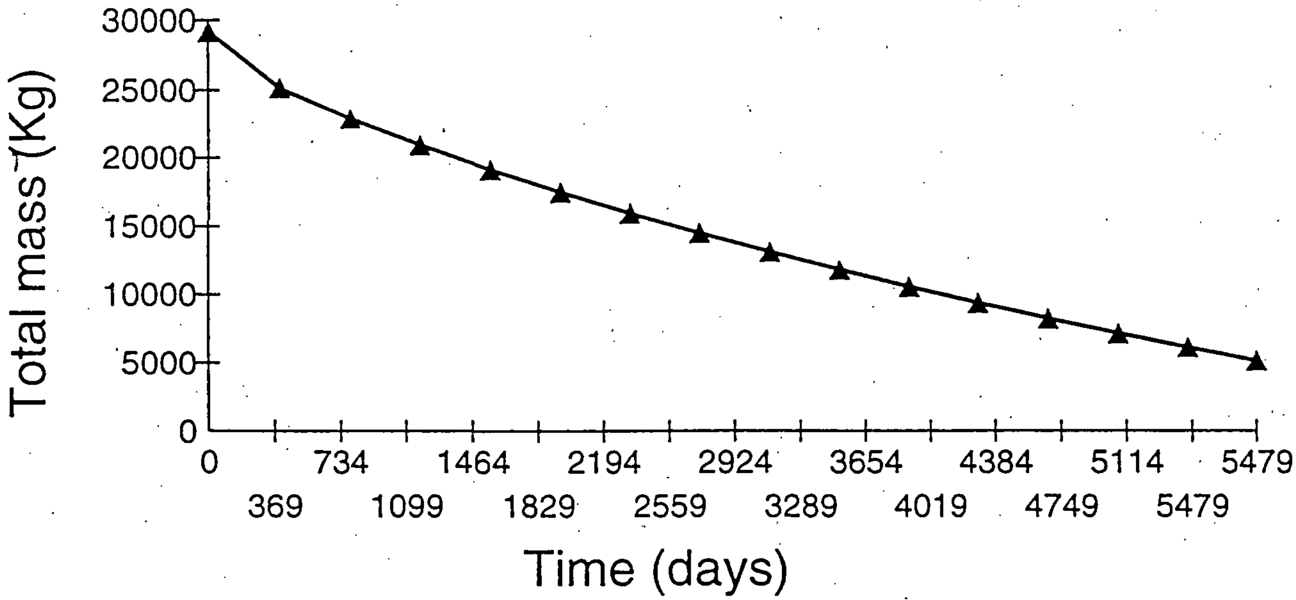
The next card discusses some of the conditions that may limit the effectiveness

| | | |
|---|---|---|
| Temperature [oeC]: | 20 | |
| Contaminant Type: | User Defined | |
| Soil Type: | User Defined | |
| Well Radius [in]: | 2 | |
| Est. Radius of Influence [ft]: | 30 | |
| Permeable Zone Thickness [ft]: | 10 | |
| Flowrate per Well (120" Vac) [SCFM] | 19.11 | |
| Flowrate per Well (120" Vac) [SCFM] | 56.77 | |
| Min. Vol. of Air [L/g-residual]: | 12.95 | |
| Estimated Spill Mass: | 1800000 | lb |
| Desired Remediation Time [days]: | 3650 | |

0.88 < **Minimum # of Wells Based on Your Input Parameters** < 2.61

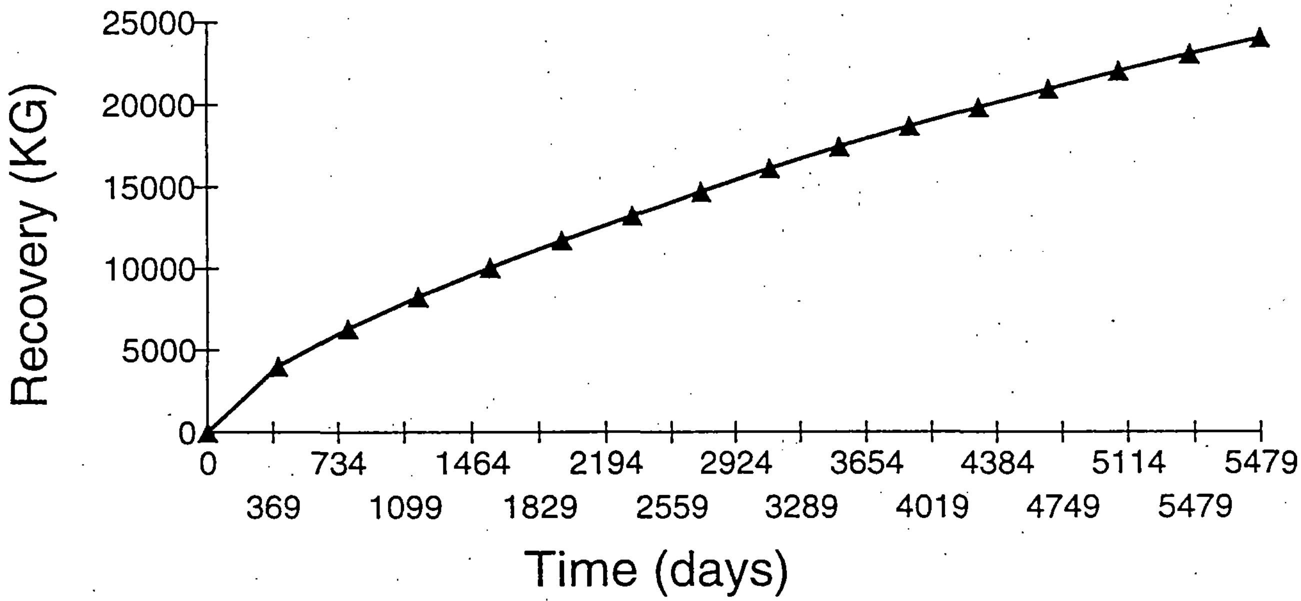
18

# ACS OFF SITE




1.75 darcy

# ACS OFF SITE



Recovery (KG)
25000
20000
15000
10000
5000
0
0
369
734
1099
1464
1829
2194
2559
2924
3289
3654
4019
4384
4749
5114
5479
5479
Time (days)

```
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
+                                                               +
+                 BioSVE For Window                             +
+                                                               +
+   SOIL VACUUM EXTRACTION CHEMICAL EQUILIBRIUM MODEL           +
+      BASED ON JOHNSON ET AL. (1990) GROUND WATER              +
+                                                               +
+                                                               +
+                                                               +
+                                                               +
+                    COPYRIGHT 1995                             +
+                  ASHOK KATYAL, Ph.D.                          +
+           DRAPER ADEN ENVIRONMENTAL MODELING                  +
+             BLACKSBURG, VA 24060, U.S.A.                      +
+                                                               +
+                                                               +
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +

TITLE: ACS OFF SITE

------


air flow rate    (liters/day)              = .7788E+06
total mass of contaminant (g)              = .2916E+08
maximum simulation time (days)             = .5475E+04
starting time step (days)                  = .5000E+00
maximum time step  (days)                  = .5000E+01
time increment factor                      =.10200E+01
printout time interval (days)              =.36500E+03
volumetric water content(fraction)         =.15000E+00
bulk density (g/cm^3)                      =.17000E+01
foc                                        =.50000E-02
contaminated soil vol. (m^3)               =.63800E+02
temperature (C)                            =.20000E+02
intercept in free prod.recov.eqn.          =.15000E+01
exponent in free prod. recov. eqn.         =.20000E-01
bio efficiency (fraction)                  =.20000E-01
residual oil mass (kg)                     =.29150E+04
venting efficiency (fraction)              = .7100E-01


SPECIES                          VAP        BOILING      SOL      KOW
                                 PRES       POINT      LIMIT
                                 atm        deg C      ppm        g/g

benzene                      .1000E+00  .8000E+02  .1780E+04  .1350E+03
toluene                      .2900E-01  .1110E+03  .5150E+03  .4900E+03
```

| | | | | |
|---|---|---|---|---|
| p-xylene | .8600E-02 | .1380E+03 | .1980E+03 | .1413E+04 |
| 111-trichloroethane | .1620E-01 | .7410E+02 | .1500E+04 | .3160E+03 |
| 1122-tetrachloroethane | .7000E-02 | .1462E+03 | .2900E+04 | .2450E+03 |
| 112-trichloroethane | .4000E-01 | .1138E+03 | .4500E+04 | .2950E+03 |
| 11-dichoroethane | .2400E+00 | .5750E+02 | .5500E+04 | .6170E+02 |
| 11-dichoroethene | .7900E+00 | .3700E+02 | .2250E+04 | .6920E+02 |
| methylenechloride | .4760E+00 | .9370E+02 | .2000E+04 | .2000E+02 |
| tetrachloroethene | .2400E-02 | .1210E+03 | .1500E+03 | .3980E+03 |
| trichloroethene | .7600E-01 | .8720E+02 | .1100E+04 | .2400E+03 |
| vinylacetate | .1500E+00 | .7200E+02 | .2000E+04 | .5000E+00 |
| vinylchloride | .3500E+01 | .1340E+02 | .2670E+04 | .2400E+02 |
| Ethylbenzene | .9200E-01 | .1362E+03 | .1520E+03 | .1410E+04 |
| MASS FRACTION SUM | 1.000000 | | | |

| SPECIES | MOL WEIGHT g/mol | HENRY COEFF DIMENSIONLESS |
|---|---|---|
| benzene | .7810E+02 | .0000E+00 |
| toluene | .9210E+02 | .0000E+00 |
| p-xylene | .1062E+03 | .0000E+00 |
| 111-trichloroethane | .1335E+03 | .0000E+00 |
| 1122-tetrachloroethane | .1678E+03 | .0000E+00 |
| 112-trichloroethane | .1334E+03 | .0000E+00 |
| 11-dichoroethane | .1820E+03 | .0000E+00 |
| 11-dichoroethene | .9694E+02 | .0000E+00 |
| methylenechloride | .1067E+03 | .0000E+00 |
| tetrachloroethene | .1658E+03 | .0000E+00 |
| trichloroethene | .1314E+03 | .0000E+00 |
| vinylacetate | .8600E+02 | .0000E+00 |
| vinylchloride | .6250E+02 | .0000E+00 |
| Ethylbenzene | .1067E+03 | .0000E+00 |

sgmlti 250509.200000

RESULTS AT TIME (DAYS) 0.000000E+00

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1326E+03 | .3480E+06 | .3042E+03 | .1466E+04 |
| toluene | .9595E+03 | .8682E+07 | .1862E+04 | .3258E+05 |
| p-xylene | .1019E+03 | .3108E+07 | .2223E+03 | .1121E+05 |
| 111-trichloroethane | .9489E+02 | .1537E+07 | .6625E+03 | .7473E+04 |
| 1122-tetrachloroethane | .2612E+03 | .9791E+07 | .6490E+04 | .5676E+05 |
| 112-trichloroethane | .5254E+02 | .3447E+06 | .4460E+03 | .4697E+04 |
| 11-dichoroethane | .3185E+03 | .3483E+06 | .4037E+03 | .8892E+03 |

| | | | | |
|---|---|---|---|---|
| 11-dichoroethene | .1047E+04 | .3478E+06 | .3096E+03 | .7649E+03 |
| methylenechloride | .1265E+04 | .6976E+06 | .5016E+03 | .3581E+03 |
| tetrachloroethene | .8795E+01 | .9616E+06 | .3337E+02 | .4742E+03 |
| trichloroethene | .1683E+03 | .5812E+06 | .1866E+03 | .1599E+04 |
| vinylacetate | .3495E+03 | .6114E+06 | .5454E+03 | .9735E+01 |
| vinylchloride | .7974E+04 | .5979E+06 | .3429E+04 | .2938E+04 |
| Ethylbenzene | .3668E+03 | .1046E+07 | .5718E+02 | .2878E+04 |

TOTAL MASS IN ALL PHASE = .2916E+05

TOTAL MASS IN GAS PHASE (kg) = .1310E+02
TOTAL MASS IN FREE PHASE (kg) = .2900E+05
TOTAL MASS IN WATER PHASE (kg) = .1545E+02
TOTAL MASS IN SOIL PHASE (kg) = .1241E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .3499E+06 | .0000E+00 | .0000E+00 | .3226E+04 |
| toluene | .8718E+07 | .0000E+00 | .0000E+00 | .8038E+05 |
| p-xylene | .3120E+07 | .0000E+00 | .0000E+00 | .2876E+05 |
| 111-trichloroethane | .1545E+07 | .0000E+00 | .0000E+00 | .1425E+05 |
| 1122-tetrachloroethane | .9855E+07 | .0000E+00 | .0000E+00 | .9086E+05 |
| 112-trichloroethane | .3499E+06 | .0000E+00 | .0000E+00 | .3226E+04 |
| 11-dichoroethane | .3499E+06 | .0000E+00 | .0000E+00 | .3226E+04 |
| 11-dichoroethene | .3499E+06 | .6078E-04 | .8561E-03 | .3226E+04 |
| methylenechloride | .6997E+06 | .1338E-03 | .1885E-02 | .6452E+04 |
| tetrachloroethene | .9621E+06 | .0000E+00 | .0000E+00 | .8871E+04 |
| trichloroethene | .5831E+06 | .0000E+00 | .0000E+00 | .5376E+04 |
| vinylacetate | .6123E+06 | .0000E+00 | .0000E+00 | .5645E+04 |
| vinylchloride | .6123E+06 | .4702E-03 | .6623E-02 | .5645E+04 |
| Ethylbenzene | .1050E+07 | .0000E+00 | .0000E+00 | .9677E+04 |

end of initial conditions

RESULTS AT TIME (DAYS) 368.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1088E+03 | .2378E+06 | .2497E+03 | .1203E+04 |
| toluene | .1030E+04 | .7762E+07 | .2000E+04 | .3498E+05 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .1182E+03 | .3002E+07 | .2579E+03 | .1301E+05 |
| 111-trichloroethane | .1069E+03 | .1442E+07 | .7465E+03 | .8422E+04 |
| 1122-tetrachloroethane | .3047E+03 | .9511E+07 | .7571E+04 | .6622E+05 |
| 112-trichloroethane | .5409E+02 | .2955E+06 | .4592E+03 | .4836E+04 |
| 11-dichoroethane | .1538E+03 | .1400E+06 | .1949E+03 | .4293E+03 |
| 11-dichoroethene | .6306E+02 | .1744E+05 | .1865E+02 | .4607E+02 |
| methylenechloride | .2490E+03 | .1143E+06 | .9869E+02 | .7047E+02 |
| tetrachloroethene | .1045E+02 | .9516E+06 | .3966E+02 | .5635E+03 |
| trichloroethene | .1512E+03 | .4348E+06 | .1677E+03 | .1437E+04 |
| vinylacetate | .2369E+03 | .3451E+06 | .3698E+03 | .6601E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3102E+03 | .7366E+06 | .4834E+02 | .2433E+04 |

TOTAL MASS IN ALL PHASE = .2514E+05

TOTAL MASS IN GAS PHASE (kg) = .2897E+01
TOTAL MASS IN FREE PHASE (kg) = .2499E+05
TOTAL MASS IN WATER PHASE (kg) = .1222E+02
TOTAL MASS IN SOIL PHASE (kg) = .1337E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .2393E+06 | .3395E+00 | .4781E+01 | .2207E+04 |
| toluene | .7800E+07 | .3201E+01 | .4509E+02 | .7192E+05 |
| p-xylene | .3016E+07 | .3668E+00 | .5166E+01 | .2780E+05 |
| 111-trichloroethane | .1452E+07 | .3320E+00 | .4676E+01 | .1338E+05 |
| 1122-tetrachloroethane | .9585E+07 | .9455E+00 | .1332E+02 | .8837E+05 |
| 112-trichloroethane | .3008E+06 | .1682E+00 | .2369E+01 | .2774E+04 |
| 11-dichoroethane | .1408E+06 | .4834E+00 | .6808E+01 | .1298E+04 |
| 11-dichoroethene | .1757E+05 | .2045E+00 | .2881E+01 | .1620E+03 |
| methylenechloride | .1147E+06 | .7932E+00 | .1117E+02 | .1058E+04 |
| tetrachloroethene | .9522E+06 | .3241E-01 | .4565E+00 | .8779E+04 |
| trichloroethene | .4365E+06 | .4711E+00 | .6635E+01 | .4025E+04 |
| vinylacetate | .3458E+06 | .7412E+00 | .1044E+02 | .3188E+04 |
| vinylchloride | .1296E+02 | .0000E+00 | .0000E+00 | .1194E+00 |
| Ethylbenzene | .7394E+06 | .9671E+00 | .1362E+02 | .6818E+04 |

RESULTS AT TIME (DAYS) 733.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |

| | | | | |
|---|---|---|---|---|
| benzene | .7939E+02 | .1552E+06 | .1821E+03 | .8778E+03 |
| toluene | .1016E+04 | .6848E+07 | .1972E+04 | .3450E+05 |
| p-xylene | .1271E+03 | .2889E+07 | .2774E+03 | .1399E+05 |
| 111-trichloroethane | .1113E+03 | .1343E+07 | .7774E+03 | .8770E+04 |
| 1122-tetrachloroethane | .3299E+03 | .9211E+07 | .8197E+04 | .7170E+05 |
| 112-trichloroethane | .5095E+02 | .2490E+06 | .4325E+03 | .4555E+04 |
| 11-dichoroethane | .6185E+02 | .5037E+05 | .7839E+02 | .1727E+03 |
| 11-dichoroethene | .2466E+01 | .6101E+03 | .7293E+00 | .1802E+01 |
| methylenechloride | .3659E+02 | .1502E+05 | .1450E+02 | .1036E+02 |
| tetrachloroethene | .1155E+02 | .9404E+06 | .4382E+02 | .6226E+03 |
| trichloroethene | .1221E+03 | .3140E+06 | .1354E+03 | .1160E+04 |
| vinylacetate | .1394E+03 | .1817E+06 | .2176E+03 | .3884E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2339E+03 | .4969E+06 | .3646E+02 | .1835E+04 |

TOTAL MASS IN ALL PHASE = .2285E+05

TOTAL MASS IN GAS PHASE (kg) = .2323E+01
TOTAL MASS IN FREE PHASE (kg) = .2269E+05
TOTAL MASS IN WATER PHASE (kg) = .1237E+02
TOTAL MASS IN SOIL PHASE (kg) = .1382E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .1563E+06 | .2461E+00 | .3467E+01 | .1441E+04 |
| toluene | .6885E+07 | .3150E+01 | .4436E+02 | .6348E+05 |
| p-xylene | .2903E+07 | .3941E+00 | .5550E+01 | .2677E+05 |
| 111-trichloroethane | .1353E+07 | .3452E+00 | .4862E+01 | .1248E+05 |
| 1122-tetrachloroethane | .9292E+07 | .1023E+01 | .1441E+02 | .8567E+05 |
| 112-trichloroethane | .2540E+06 | .1580E+00 | .2225E+01 | .2342E+04 |
| 11-dichoroethane | .5069E+05 | .1917E+00 | .2700E+01 | .4673E+03 |
| 11-dichoroethene | .6152E+03 | .7625E-02 | .1074E+00 | .5672E+01 |
| methylenechloride | .1509E+05 | .1133E+00 | .1596E+01 | .1391E+03 |
| tetrachloroethene | .9411E+06 | .3580E-01 | .5043E+00 | .8677E+04 |
| trichloroethene | .3154E+06 | .3785E+00 | .5331E+01 | .2908E+04 |
| vinylacetate | .1820E+06 | .4322E+00 | .6087E+01 | .1678E+04 |
| vinylchloride | .1043E+02 | .0000E+00 | .0000E+00 | .9612E-01 |
| Ethylbenzene | .4990E+06 | .7252E+00 | .1021E+02 | .4601E+04 |

RESULTS AT TIME (DAYS) 1098.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .5475E+02 | .9652E+05 | .1256E+03 | .6054E+03 |
| toluene | .9800E+03 | .5957E+07 | .1902E+04 | .3327E+05 |
| p-xylene | .1350E+03 | .2768E+07 | .2947E+03 | .1486E+05 |
| 111-trichloroethane | .1141E+03 | .1242E+07 | .7966E+03 | .8987E+04 |
| 1122-tetrachloroethane | .3530E+03 | .8890E+07 | .8772E+04 | .7672E+05 |
| 112-trichloroethane | .4671E+02 | .2059E+06 | .3965E+03 | .4176E+04 |
| 11-dichoroethane | .2196E+02 | .1613E+05 | .2783E+02 | .6130E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .4202E+01 | .1556E+04 | .1666E+01 | .1189E+01 |
| tetrachloroethene | .1264E+02 | .9283E+06 | .4795E+02 | .6814E+03 |
| trichloroethene | .9426E+02 | .2186E+06 | .1045E+03 | .8954E+03 |
| vinylacetate | .7564E+02 | .8890E+05 | .1181E+03 | .2107E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| *Ethylbenzene* | *.1674E+03* | *.3207E+06* | *.2609E+02* | *.1313E+04* |

TOTAL MASS IN ALL PHASE = .2089E+05

TOTAL MASS IN GAS PHASE (kg) = .2060E+01
TOTAL MASS IN FREE PHASE (kg) = .2073E+05
TOTAL MASS IN WATER PHASE (kg) = .1261E+02
TOTAL MASS IN SOIL PHASE (kg) = .1416E+03

| SPECIES | MASS | CONC | CONC | CONC |
|---|---|---|---|---|
| | | WELL GAS | SOIL GAS | SOIL MAS |
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .9731E+05 | .1710E+00 | .2408E+01 | .8972E+03 |
| toluene | .5993E+07 | .3045E+01 | .4289E+02 | .5526E+05 |
| p-xylene | .2783E+07 | .4190E+00 | .5901E+01 | .2566E+05 |
| 111-trichloroethane | .1252E+07 | .3542E+00 | .4989E+01 | .1154E+05 |
| 1122-tetrachloroethane | .8976E+07 | .1095E+01 | .1543E+02 | .8276E+05 |
| 112-trichloroethane | .2105E+06 | .1452E+00 | .2046E+01 | .1941E+04 |
| 11-dichoroethane | .1624E+05 | .6922E-01 | .9749E+00 | .1497E+03 |
| *11-dichoroethene* | *.1599E+02* | *.0000E+00* | *.0000E+00* | *.1474E+00* |
| methylenechloride | .1563E+04 | .1347E-01 | .1897E+00 | .1442E+02 |
| tetrachloroethene | .9290E+06 | .3919E-01 | .5520E+00 | .8565E+04 |
| trichloroethene | .2197E+06 | .2938E+00 | .4138E+01 | .2026E+04 |
| vinylacetate | .8909E+05 | .2370E+00 | .3338E+01 | .8214E+03 |
| vinylchloride | .1041E+02 | .0000E+00 | .0000E+00 | .9598E-01 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .3222E+06 | .5223E+00 | .7356E+01 | .2971E+04 |

RESULTS AT TIME (DAYS) 1463.606000

| SPECIES | GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| | ........MASS (g) IN PHASES .... | | | |
| benzene | .3594E+02 | .5703E+05 | .8244E+02 | .3973E+03 |
| toluene | .9328E+03 | .5105E+07 | .1811E+04 | .3167E+05 |
| p-xylene | .1430E+03 | .2640E+07 | .3122E+03 | .1575E+05 |
| 111-trichloroethane | .1161E+03 | .1138E+07 | .8109E+03 | .9148E+04 |
| 1122-tetrachloroethane | .3770E+03 | .8547E+07 | .9368E+04 | .8194E+05 |
| 112-trichloroethane | .4205E+02 | .1668E+06 | .3569E+03 | .3759E+04 |
| 11-dichoroethane | .6899E+01 | .4562E+04 | .8744E+01 | .1926E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .3776E+00 | .1259E+03 | .1497E+00 | .1069E+00 |
| tetrachloroethene | .1384E+02 | .9149E+06 | .5251E+02 | .7460E+03 |
| trichloroethene | .7008E+02 | .1463E+06 | .7771E+02 | .6658E+03 |
| vinylacetate | .3803E+02 | .4023E+05 | .5935E+02 | .1059E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1144E+03 | .1973E+06 | .1783E+02 | .8975E+03 |

TOTAL MASS IN ALL PHASE = .1912E+05

TOTAL MASS IN GAS PHASE (kg) = .1891E+01
TOTAL MASS IN FREE PHASE (kg) = .1896E+05
TOTAL MASS IN WATER PHASE (kg) = .1296E+02
TOTAL MASS IN SOIL PHASE (kg) = .1450E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .5754E+05 | .1114E+00 | .1569E+01 | .5306E+03 |
| toluene | .5139E+07 | .2892E+01 | .4073E+02 | .4738E+05 |
| p-xylene | .2656E+07 | .4435E+00 | .6246E+01 | .2449E+05 |
| 111-trichloroethane | .1148E+07 | .3601E+00 | .5072E+01 | .1058E+05 |
| 1122-tetrachloroethane | .8639E+07 | .1169E+01 | .1646E+02 | .7965E+05 |
| 112-trichloroethane | .1710E+06 | .1303E+00 | .1836E+01 | .1576E+04 |
| 11-dichoroethane | .4597E+04 | .2138E-01 | .3011E+00 | .4238E+02 |
| 11-dichoroethene | .1420E+02 | .0000E+00 | .0000E+00 | .1309E+00 |
| methylenechloride | .1265E+03 | .1169E-02 | .1646E-01 | .1167E+01 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .9157E+06 | .4289E-01 | .6041E+00 | .8443E+04 |
| trichloroethene | .1472E+06 | .2173E+00 | .3060E+01 | .1357E+04 |
| vinylacetate | .4033E+05 | .1179E+00 | .1660E+01 | .3718E+03 |
| vinylchloride | .7881E+01 | .0000E+00 | .0000E+00 | .7266E-01 |
| Ethylbenzene | .1983E+06 | .3546E+00 | .4994E+01 | .1829E+04 |

RESULTS AT TIME (DAYS) 1828.606000 5 yrs

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .2228E+02 | .3181E+05 | .5111E+02 | .2463E+03 |
| toluene | .8735E+03 | .4301E+07 | .1695E+04 | .2966E+05 |
| p-xylene | .1508E+03 | .2504E+07 | .3292E+03 | .1660E+05 |
| 111-trichloroethane | .1172E+03 | .1033E+07 | .8180E+03 | .9228E+04 |
| 1122-tetrachloroethane | .4012E+03 | .8183E+07 | .9968E+04 | .8719E+05 |
| 112-trichloroethane | .3702E+02 | .1321E+06 | .3143E+03 | .3310E+04 |
| 11-dichoroethane | .1890E+01 | .1125E+04 | .2396E+01 | .5277E+01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1513E+02 | .9004E+06 | .5743E+02 | .8160E+03 |
| trichloroethene | .4989E+02 | .9374E+05 | .5532E+02 | .4740E+03 |
| vinylacetate | .1753E+02 | .1669E+05 | .2736E+02 | .4884E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .7417E+02 | .1151E+06 | .1156E+02 | .5819E+03 |

TOTAL MASS IN ALL PHASE = .1747E+05

TOTAL MASS IN GAS PHASE (kg) = .1761E+01
TOTAL MASS IN FREE PHASE (kg) = .1731E+05
TOTAL MASS IN WATER PHASE (kg) = .1333E+02
TOTAL MASS IN SOIL PHASE (kg) = .1481E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .3213E+05 | .6907E-01 | .9728E+00 | .2962E+03 |
| toluene | .4333E+07 | .2708E+01 | .3814E+02 | .3995E+05 |
| p-xylene | .2521E+07 | .4676E+00 | .6586E+01 | .2325E+05 |
| 111-trichloroethane | .1043E+07 | .3633E+00 | .5117E+01 | .9615E+04 |
| 1122-tetrachloroethane | .8280E+07 | .1244E+01 | .1752E+02 | .7634E+05 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .1358E+06 | .1148E+00 | .1616E+01 | .1252E+04 |
| 11-dichoroethane | .1134E+04 | .5857E-02 | .8250E-01 | .1046E+02 |
| 11-dichoroethene | .1241E+02 | .0000E+00 | .0000E+00 | .1144E+00 |
| methylenechloride | .1410E+02 | .0000E+00 | .0000E+00 | .1300E+00 |
| tetrachloroethene | .9013E+06 | .4693E-01 | .6609E+00 | .8310E+04 |
| trichloroethene | .9432E+05 | .1547E+00 | .2179E+01 | .8696E+03 |
| vinylacetate | .1674E+05 | .5435E-01 | .7655E+00 | .1543E+03 |
| vinylchloride | .7867E+01 | .0000E+00 | .0000E+00 | .7253E-01 |
| Ethylbenzene | .1158E+06 | .2299E+00 | .3238E+01 | .1067E+04 |

RESULTS AT TIME (DAYS) 2193.606000 6 yrs

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1297E+02 | .1663E+05 | .2976E+02 | .1434E+03 |
| toluene | .8039E+03 | .3554E+07 | .1560E+04 | .2730E+05 |
| p-xylene | .1584E+03 | .2362E+07 | .3457E+03 | .1744E+05 |
| 111-trichloroethane | .1172E+03 | .9272E+06 | .8179E+03 | .9227E+04 |
| 1122-tetrachloroethane | .4256E+03 | .7795E+07 | .1058E+05 | .9250E+05 |
| 112-trichloroethane | .3183E+02 | .1020E+06 | .2702E+03 | .2846E+04 |
| 11-dichoroethane | .4448E+00 | .2376E+03 | .5638E+00 | .1242E+01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1656E+02 | .8845E+06 | .6283E+02 | .8927E+03 |
| trichloroethene | .3386E+02 | .5713E+05 | .3755E+02 | .3217E+03 |
| vinylacetate | .7343E+01 | .6277E+04 | .1146E+02 | .2046E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .4537E+02 | .6323E+05 | .7072E+01 | .3560E+03 |

TOTAL MASS IN ALL PHASE = .1594E+05

TOTAL MASS IN GAS PHASE (kg) = .1654E+01
TOTAL MASS IN FREE PHASE (kg) = .1577E+05
TOTAL MASS IN WATER PHASE (kg) = .1372E+02
TOTAL MASS IN SOIL PHASE (kg) = .1510E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .1682E+05 | .4062E-01 | .5721E+00 | .1551E+03 |

| | | | | |
|---|---|---|---|---|
| toluene | .3584E+07 | .2501E+01 | .3523E+02 | .3304E+05 |
| p-xylene | .2380E+07 | .4919E+00 | .6928E+01 | .2194E+05 |
| 111-trichloroethane | .9374E+06 | .3640E+00 | .5127E+01 | .8643E+04 |
| 1122-tetrachloroethane | .7899E+07 | .1321E+01 | .1861E+02 | .7283E+05 |
| 112-trichloroethane | .1052E+06 | .9912E-01 | .1396E+01 | .9698E+03 |
| 11-dichoroethane | .2399E+03 | .1412E-02 | .1989E-01 | .2212E+01 |
| 11-dichoroethene | .1150E+02 | .0000E+00 | .0000E+00 | .1061E+00 |
| methylenechloride | .1290E+02 | .0000E+00 | .0000E+00 | .1189E+00 |
| tetrachloroethene | .8855E+06 | .5137E-01 | .7236E+00 | .8164E+04 |
| trichloroethene | .5752E+05 | .1058E+00 | .1490E+01 | .5303E+03 |
| vinylacetate | .6296E+04 | .2311E-01 | .3255E+00 | .5805E+02 |
| vinylchloride | .5333E+01 | .0000E+00 | .0000E+00 | .4917E-01 |
| Ethylbenzene | .6364E+05 | .1420E+00 | .2000E+01 | .5867E+03 |

RESULTS AT TIME (DAYS) 2558.606000 7 yrs

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .7049E+01 | .8068E+04 | .1617E+02 | .7794E+02 |
| toluene | .7280E+03 | .2874E+07 | .1413E+04 | .2472E+05 |
| p-xylene | .1662E+03 | .2213E+07 | .3628E+03 | .1830E+05 |
| 111-trichloroethane | .1164E+03 | .8222E+06 | .8125E+03 | .9166E+04 |
| 1122-tetrachloroethane | .4517E+03 | .7385E+07 | .1122E+05 | .9816E+05 |
| 112-trichloroethane | .2674E+02 | .7651E+05 | .2270E+03 | .2390E+04 |
| 11-dichoroethane | .8805E-01 | .4199E+02 | .1116E+00 | .2458E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1818E+02 | .8671E+06 | .6899E+02 | .9803E+03 |
| trichloroethene | .2183E+02 | .3287E+05 | .2420E+02 | .2074E+03 |
| vinylacetate | .2762E+01 | .2107E+04 | .4310E+01 | .7693E-01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2604E+02 | .3240E+05 | .4060E+01 | .2043E+03 |

TOTAL MASS IN ALL PHASE = .1448E+05

TOTAL MASS IN GAS PHASE (kg) = .1565E+01
TOTAL MASS IN FREE PHASE (kg) = .1431E+05
TOTAL MASS IN WATER PHASE (kg) = .1416E+02
TOTAL MASS IN SOIL PHASE (kg) = .1542E+03

| SPECIES | MASS | CONC | CONC | CONC |
|---|---|---|---|---|
| | | WELL GAS | SOIL GAS | SOIL MAS |

S

| | g | g/m3 | g/m3 | mg/kg |
|---|---|---|---|---|
| benzene | .8170E+04 | .2185E-01 | .3077E+00 | .7532E+02 |
| toluene | .2900E+07 | .2257E+01 | .3179E+02 | .2674E+05 |
| p-xylene | .2231E+07 | .5154E+00 | .7259E+01 | .2057E+05 |
| 111-trichloroethane | .8323E+06 | .3608E+00 | .5081E+01 | .7674E+04 |
| 1122-tetrachloroethane | .7495E+07 | .1400E+01 | .1972E+02 | .6910E+05 |
| 112-trichloroethane | .7915E+05 | .8288E-01 | .1167E+01 | .7298E+03 |
| 11-dichoroethane | .4244E+02 | .2728E-03 | .3842E-02 | .3913E+00 |
| 11-dichoroethene | .9719E+01 | .0000E+00 | .0000E+00 | .8961E-01 |
| methylenechloride | .1112E+02 | .0000E+00 | .0000E+00 | .1025E+00 |
| tetrachloroethene | .8682E+06 | .5639E-01 | .7942E+00 | .8005E+04 |
| trichloroethene | .3313E+05 | .6767E-01 | .9530E+00 | .3054E+03 |
| vinylacetate | .2114E+04 | .8559E-02 | .1205E+00 | .1949E+02 |
| vinylchloride | .5321E+01 | .0000E+00 | .0000E+00 | .4906E-01 |
| Ethylbenzene | .3264E+05 | .8073E-01 | .1137E+01 | .3009E+03 |

RESULTS AT TIME (DAYS) 2923.606000 8 yrs

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .3522E+01 | .3587E+04 | .8080E+01 | .3894E+02 |
| toluene | .6447E+03 | .2264E+07 | .1251E+04 | .2189E+05 |
| p-xylene | .1736E+03 | .2056E+07 | .3789E+03 | .1911E+05 |
| 111-trichloroethane | .1143E+03 | .7186E+06 | .7980E+03 | .9003E+04 |
| 1122-tetrachloroethane | .4777E+03 | .6951E+07 | .1187E+05 | .1038E+06 |
| 112-trichloroethane | .2177E+02 | .5544E+05 | .1848E+03 | .1947E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1999E+02 | .8481E+06 | .7584E+02 | .1078E+04 |
| trichloroethene | .1320E+02 | .1769E+05 | .1464E+02 | .1254E+03 |
| vinylacetate | .9122E+00 | .6194E+03 | .1424E+01 | .2541E-01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1383E+02 | .1531E+05 | .2156E+01 | .1085E+03 |

TOTAL MASS IN ALL PHASE = .1310E+05

TOTAL MASS IN GAS PHASE (kg) = .1484E+01
TOTAL MASS IN FREE PHASE (kg) = .1293E+05
TOTAL MASS IN WATER PHASE (kg) = .1459E+02
TOTAL MASS IN SOIL PHASE (kg) = .1571E+03

| SPECIES S | MASS g | CONC WELL GAS g/m3 | CONC SOIL GAS g/m3 | CONC SOIL MASS mg/kg |
|---|---|---|---|---|
| benzene | .3638E+04 | .1106E-01 | .1557E+00 | .3354E+02 |
| toluene | .2288E+07 | .2007E+01 | .2827E+02 | .2109E+05 |
| p-xylene | .2076E+07 | .5392E+00 | .7595E+01 | .1914E+05 |
| 111-trichloroethane | .7285E+06 | .3553E+00 | .5004E+01 | .6717E+04 |
| 1122-tetrachloroethane | .7067E+07 | .1483E+01 | .2089E+02 | .6516E+05 |
| 112-trichloroethane | .5760E+05 | .6787E-01 | .9559E+00 | .5311E+03 |
| 11-dichoroethane | .1759E+02 | .0000E+00 | .0000E+00 | .1621E+00 |
| 11-dichoroethene | .8814E+01 | .0000E+00 | .0000E+00 | .8127E-01 |
| methylenechloride | .9928E+01 | .0000E+00 | .0000E+00 | .9154E-01 |
| tetrachloroethene | .8493E+06 | .6200E-01 | .8732E+00 | .7830E+04 |
| trichloroethene | .1785E+05 | .4133E-01 | .5821E+00 | .1646E+03 |
| vinylacetate | .6218E+03 | .2881E-02 | .4058E-01 | .5733E+01 |
| vinylchloride | .5308E+01 | .0000E+00 | .0000E+00 | .4894E-01 |
| Ethylbenzene | .1544E+05 | .4338E-01 | .6110E+00 | .1423E+03 |

RESULTS AT TIME (DAYS) 3288.606000 9 yrs

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1602E+01 | .1440E+04 | .3674E+01 | .1771E+02 |
| toluene | .5583E+03 | .1731E+07 | .1084E+04 | .1896E+05 |
| p-xylene | .1811E+03 | .1893E+07 | .3953E+03 | .1994E+05 |
| 111-trichloroethane | .1113E+03 | .6174E+06 | .7767E+03 | .8763E+04 |
| 1122-tetrachloroethane | .5054E+03 | .6492E+07 | .1256E+05 | .1099E+06 |
| 112-trichloroethane | .1718E+02 | .3861E+05 | .1458E+03 | .1536E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2208E+02 | .8271E+06 | .8378E+02 | .1190E+04 |
| trichloroethene | .7441E+01 | .8803E+04 | .8251E+01 | .7069E+02 |
| vinylacetate | .2599E+00 | .1558E+03 | .4056E+00 | .7240E-02 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .6733E+01 | .6580E+04 | .1050E+01 | .5283E+02 |

TOTAL MASS IN ALL PHASE = .1179E+05

TOTAL MASS IN GAS PHASE (kg) = .1411E+01
TOTAL MASS IN FREE PHASE (kg) = .1162E+05
TOTAL MASS IN WATER PHASE (kg) = .1506E+02

TOTAL MASS IN SOIL PHASE (kg) = .1604E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .1463E+04 | .4963E-02 | .6990E-01 | .1349E+02 |
| toluene | .1751E+07 | .1731E+01 | .2437E+02 | .1615E+05 |
| p-xylene | .1914E+07 | .5614E+00 | .7907E+01 | .1765E+05 |
| 111-trichloroethane | .6271E+06 | .3448E+00 | .4857E+01 | .5782E+04 |
| 1122-tetrachloroethane | .6614E+07 | .1567E+01 | .2207E+02 | .6098E+05 |
| 112-trichloroethane | .4031E+05 | .5325E-01 | .7500E+00 | .3717E+03 |
| 11-dichoroethane | .1553E+02 | .0000E+00 | .0000E+00 | .1432E+00 |
| 11-dichoroethene | .7911E+01 | .0000E+00 | .0000E+00 | .7294E-01 |
| methylenechloride | .8734E+01 | .0000E+00 | .0000E+00 | .8053E-01 |
| tetrachloroethene | .8284E+06 | .6844E-01 | .9640E+00 | .7638E+04 |
| trichloroethene | .8889E+04 | .2306E-01 | .3248E+00 | .8196E+02 |
| vinylacetate | .1564E+03 | .8052E-03 | .1134E-01 | .1442E+01 |
| vinylchloride | .5294E+01 | .0000E+00 | .0000E+00 | .4881E-01 |
| Ethylbenzene | .6641E+04 | .2087E-01 | .2939E+00 | .6123E+02 |

RESULTS AT TIME (DAYS) 3653.606000 10yrs

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .6502E+00 | .5128E+03 | .1492E+01 | .7189E+01 |
| toluene | .4694E+03 | .1277E+07 | .9111E+03 | .1594E+05 |
| p-xylene | .1880E+03 | .1724E+07 | .4103E+03 | .2070E+05 |
| 111-trichloroethane | .1068E+03 | .5198E+06 | .7455E+03 | .8410E+04 |
| 1122-tetrachloroethane | .5332E+03 | .6007E+07 | .1325E+05 | .1159E+06 |
| 112-trichloroethane | .1301E+02 | .2566E+05 | .1105E+03 | .1164E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2447E+02 | .8040E+06 | .9284E+02 | .1319E+04 |
| trichloroethene | .3847E+01 | .3992E+04 | .4266E+01 | .3655E+02 |
| vinylacetate | .6216E-01 | .3268E+02 | .9701E-01 | .1732E-02 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2950E+01 | .2529E+04 | .4598E+00 | .2314E+02 |

TOTAL MASS IN ALL PHASE = .1055E+05

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TOTAL MASS IN GAS PHASE (kg)      = .1342E+01
TOTAL MASS IN FREE PHASE (kg)     = .1036E+05
TOTAL MASS IN WATER PHASE (kg)    = .1553E+02
TOTAL MASS IN SOIL PHASE (kg)     = .1635E+03
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| SPECIES<br>S | MASS<br>g | CONC<br>WELL GAS<br>g/m3 | CONC<br>SOIL GAS<br>g/m3 | CONC<br>SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .5222E+03 | .2015E-02 | .2838E-01 | .4814E+01 |
| toluene | .1294E+07 | .1455E+01 | .2050E+02 | .1193E+05 |
| p-xylene | .1745E+07 | .5829E+00 | .8209E+01 | .1609E+05 |
| 111-trichloroethane | .5291E+06 | .3310E+00 | .4662E+01 | .4878E+04 |
| 1122-tetrachloroethane | .6137E+07 | .1653E+01 | .2328E+02 | .5658E+05 |
| 112-trichloroethane | .2695E+05 | .4034E-01 | .5682E+00 | .2485E+03 |
| 11-dichoroethane | .1348E+02 | .0000E+00 | .0000E+00 | .1243E+00 |
| 11-dichoroethene | .7008E+01 | .0000E+00 | .0000E+00 | .6462E-01 |
| methylenechloride | .7537E+01 | .0000E+00 | .0000E+00 | .6949E-01 |
| tetrachloroethene | .8054E+06 | .7585E-01 | .1068E+01 | .7426E+04 |
| trichloroethene | .4037E+04 | .1193E-01 | .1680E+00 | .3722E+02 |
| vinylacetate | .3284E+02 | .1926E-03 | .2713E-02 | .3028E+00 |
| vinylchloride | .2771E+01 | .0000E+00 | .0000E+00 | .2554E-01 |
| Ethylbenzene | .2555E+04 | .9143E-02 | .1288E+00 | .2356E+02 |

RESULTS AT TIME (DAYS) 4018.606000 11 yrs

| SPECIES | ........MASS (g) IN PHASES ....<br>GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .2311E+00 | .1587E+03 | .5303E+00 | .2556E+01 |
| toluene | .3810E+03 | .9018E+06 | .7396E+03 | .1294E+05 |
| p-xylene | .1941E+03 | .1549E+07 | .4236E+03 | .2137E+05 |
| 111-trichloroethane | .1008E+03 | .4271E+06 | .7038E+03 | .7940E+04 |
| 1122-tetrachloroethane | .5607E+03 | .5498E+07 | .1393E+05 | .1219E+06 |
| 112-trichloroethane | .9400E+01 | .1613E+05 | .7979E+02 | .8404E+03 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2721E+02 | .7783E+06 | .1033E+03 | .1467E+04 |
| trichloroethene | .1797E+01 | .1623E+04 | .1992E+01 | .1707E+02 |
| vinylacetate | .1249E-01 | .5714E+01 | .1949E-01 | .3479E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .1142E+01 | .8518E+03 | .1780E+00 | .8958E+01 |

TOTAL MASS IN ALL PHASE = .9357E+04

TOTAL MASS IN GAS PHASE (kg) = .1276E+01
TOTAL MASS IN FREE PHASE (kg) = .9174E+04
TOTAL MASS IN WATER PHASE (kg) = .1599E+02
TOTAL MASS IN SOIL PHASE (kg) = .1664E+03

| SPECIES S | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .1620E+03 | .7162E-03 | .1009E-01 | .1494E+01 |
| toluene | .9159E+06 | .1181E+01 | .1664E+02 | .8445E+04 |
| p-xylene | .1571E+07 | .6018E+00 | .8476E+01 | .1449E+05 |
| 111-trichloroethane | .4359E+06 | .3125E+00 | .4401E+01 | .4019E+04 |
| 1122-tetrachloroethane | .5634E+07 | .1738E+01 | .2448E+02 | .5195E+05 |
| 112-trichloroethane | .1706E+05 | .2913E-01 | .4103E+00 | .1573E+03 |
| 11-dichoroethane | .1142E+02 | .1293E-03 | .1821E-02 | .1053E+00 |
| 11-dichoroethene | .6106E+01 | .0000E+00 | .0000E+00 | .5630E-01 |
| methylenechloride | .6927E+01 | .0000E+00 | .0000E+00 | .6387E-01 |
| tetrachloroethene | .7799E+06 | .8437E-01 | .1188E+01 | .7191E+04 |
| trichloroethene | .1644E+04 | .5569E-02 | .7843E-01 | .1515E+02 |
| vinylacetate | .5731E+01 | .0000E+00 | .0000E+00 | .5284E-01 |
| vinylchloride | .2761E+01 | .0000E+00 | .0000E+00 | .2546E-01 |
| Ethylbenzene | .8621E+03 | .3538E-02 | .4983E-01 | .7949E+01 |

RESULTS AT TIME (DAYS) 4383.606000 12 y3

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .6968E-01 | .4124E+02 | .1599E+00 | .7704E+00 |
| toluene | .2962E+03 | .6045E+06 | .5749E+03 | .1006E+05 |
| p-xylene | .1990E+03 | .1370E+07 | .4343E+03 | .2191E+05 |
| 111-trichloroethane | .9325E+02 | .3407E+06 | .6510E+03 | .7344E+04 |
| 1122-tetrachloroethane | .5872E+03 | .4965E+07 | .1459E+05 | .1276E+06 |
| 112-trichloroethane | .6405E+01 | .9478E+04 | .5438E+02 | .5727E+03 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .3040E+02 | .7498E+06 | .1154E+03 | .1639E+04 |
| trichloroethene | .7397E+00 | .5760E+03 | .8201E+00 | .7027E+01 |
| vinylacetate | .1255E-01 | .4952E+01 | .1959E-01 | .3496E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3788E+00 | .2437E+03 | .5904E-01 | .2972E+01 |

TOTAL MASS IN ALL PHASE = .8227E+04

TOTAL MASS IN GAS PHASE (kg) = .1214E+01
TOTAL MASS IN FREE PHASE (kg) = .8040E+04
TOTAL MASS IN WATER PHASE (kg) = .1642E+02
TOTAL MASS IN SOIL PHASE (kg) = .1692E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .4225E+02 | .2158E-03 | .3040E-02 | .3895E+00 |
| toluene | .6154E+06 | .9181E+00 | .1293E+02 | .5674E+04 |
| p-xylene | .1392E+07 | .6169E+00 | .8688E+01 | .1283E+05 |
| 111-trichloroethane | .3488E+06 | .2891E+00 | .4071E+01 | .3216E+04 |
| 1122-tetrachloroethane | .5108E+07 | .1820E+01 | .2564E+02 | .4709E+05 |
| 112-trichloroethane | .1011E+05 | .1985E-01 | .2796E+00 | .9323E+02 |
| 11-dichoroethane | .9875E+01 | .0000E+00 | .0000E+00 | .9105E-01 |
| 11-dichoroethene | .5202E+01 | .0000E+00 | .0000E+00 | .4796E-01 |
| methylenechloride | .5732E+01 | .0000E+00 | .0000E+00 | .5285E-01 |
| tetrachloroethene | .7516E+06 | .9425E-01 | .1327E+01 | .6929E+04 |
| trichloroethene | .5846E+03 | .2292E-02 | .3228E-01 | .5390E+01 |
| vinylacetate | .4968E+01 | .0000E+00 | .0000E+00 | .4580E-01 |
| vinylchloride | .2751E+01 | .0000E+00 | .0000E+00 | .2536E-01 |
| Ethylbenzene | .2471E+03 | .1174E-02 | .1653E-01 | .2278E+01 |

RESULTS AT TIME (DAYS) 4748.606000 13 yrs

| SPECIES | ........MASS (g) IN PHASES ....<br>GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1712E-01 | .8637E+01 | .3928E-01 | .1893E+00 |
| toluene | .2182E+03 | .3796E+06 | .4236E+03 | .7409E+04 |
| p-xylene | .2022E+03 | .1186E+07 | .4413E+03 | .2226E+05 |
| 111-trichloroethane | .8410E+02 | .2619E+06 | .5872E+03 | .6624E+04 |
| 1122-tetrachloroethane | .6117E+03 | .4409E+07 | .1520E+05 | .1330E+06 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .4065E+01 | .5126E+04 | .3451E+02 | .3634E+03 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .4834E-01 | .5123E+01 | .1916E-01 | .1368E-01 |
| tetrachloroethene | .3415E+02 | .7179E+06 | .1296E+03 | .1841E+04 |
| trichloroethene | .2604E+00 | .1728E+03 | .2887E+00 | .2473E+01 |
| vinylacetate | .1246E-01 | .4189E+01 | .1944E-01 | .3470E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1038E+00 | .5692E+02 | .1618E-01 | .8144E+00 |

TOTAL MASS IN ALL PHASE = .7149E+04

TOTAL MASS IN GAS PHASE (kg) = .1155E+01
TOTAL MASS IN FREE PHASE (kg) = .6960E+04
TOTAL MASS IN WATER PHASE (kg) = .1682E+02
TOTAL MASS IN SOIL PHASE (kg) = .1715E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .8885E+01 | .5302E-04 | .7468E-03 | .8192E-01 |
| toluene | .3877E+06 | .6763E+00 | .9526E+01 | .3575E+04 |
| p-xylene | .1209E+07 | .6268E+00 | .8829E+01 | .1115E+05 |
| 111-trichloroethane | .2692E+06 | .2607E+00 | .3671E+01 | .2482E+04 |
| 1122-tetrachloroethane | .4557E+07 | .1896E+01 | .2671E+02 | .4202E+05 |
| 112-trichloroethane | .5529E+04 | .1259E-01 | .1774E+00 | .5098E+02 |
| 11-dichoroethane | .8324E+01 | .0000E+00 | .0000E+00 | .7675E-01 |
| 11-dichoroethene | .4299E+01 | .0000E+00 | .0000E+00 | .3964E-01 |
| methylenechloride | .5123E+01 | .0000E+00 | .0000E+00 | .4723E-01 |
| tetrachloroethene | .7199E+06 | .1058E+00 | .1491E+01 | .6637E+04 |
| trichloroethene | .1759E+03 | .8066E-03 | .1136E-01 | .1622E+01 |
| vinylacetate | .4205E+01 | .0000E+00 | .0000E+00 | .3877E-01 |
| vinylchloride | .2739E+01 | .0000E+00 | .0000E+00 | .2525E-01 |
| Ethylbenzene | .5786E+02 | .3215E-03 | .4528E-02 | .5335E+00 |

RESULTS AT TIME (DAYS) 5113.606000 14 yrs

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .7619E-02 | .3229E+01 | .1748E-01 | .8424E-01 |

| | | | | |
|---|---|---|---|---|
| toluene | .1502E+03 | .2195E+06 | .2916E+03 | .5101E+04 |
| p-xylene | .2033E+03 | .1002E+07 | .4436E+03 | .2238E+05 |
| 111-trichloroethane | .7347E+02 | .1922E+06 | .5129E+03 | .5786E+04 |
| 1122-tetrachloroethane | .6331E+03 | .3833E+07 | .1573E+05 | .1376E+06 |
| 112-trichloroethane | .2361E+01 | .2501E+04 | .2004E+02 | .2110E+03 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .3862E+02 | .6820E+06 | .1466E+03 | .2082E+04 |
| trichloroethene | .7521E-01 | .4194E+02 | .8339E-01 | .7145E+00 |
| vinylacetate | .1266E-01 | .3575E+01 | .1975E-01 | .3526E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2234E-01 | .1029E+02 | .3482E-02 | .1753E+00 |

TOTAL MASS IN ALL PHASE = .6122E+04

TOTAL MASS IN GAS PHASE (kg) = .1101E+01
TOTAL MASS IN FREE PHASE (kg) = .5931E+04
TOTAL MASS IN WATER PHASE (kg) = .1715E+02
TOTAL MASS IN SOIL PHASE (kg) = .1732E+03

| SPECIES<br>S | MASS<br>g | CONC WELL GAS<br>g/m3 | CONC SOIL GAS<br>g/m3 | CONC SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .3283E+01 | .0000E+00 | .0000E+00 | .3027E-01 |
| toluene | .2251E+06 | .4655E+00 | .6557E+01 | .2075E+04 |
| p-xylene | .1025E+07 | .6300E+00 | .8873E+01 | .9447E+04 |
| 111-trichloroethane | .1985E+06 | .2277E+00 | .3206E+01 | .1831E+04 |
| 1122-tetrachloroethane | .3987E+07 | .1962E+01 | .2764E+02 | .3676E+05 |
| 112-trichloroethane | .2735E+04 | .7311E-02 | .1030E+00 | .2522E+02 |
| 11-dichoroethane | .7281E+01 | .0000E+00 | .0000E+00 | .6713E-01 |
| 11-dichoroethene | .3396E+01 | .0000E+00 | .0000E+00 | .3131E-01 |
| methylenechloride | .3929E+01 | .0000E+00 | .0000E+00 | .3622E-01 |
| tetrachloroethene | .6842E+06 | .1197E+00 | .1686E+01 | .6309E+04 |
| trichloroethene | .4282E+02 | .2329E-03 | .3281E-02 | .3948E+00 |
| vinylacetate | .3592E+01 | .0000E+00 | .0000E+00 | .3312E-01 |
| vinylchloride | .2079E+00 | .0000E+00 | .0000E+00 | .1917E-02 |
| Ethylbenzene | .1049E+02 | .6916E-04 | .9741E-03 | .9674E-01 |

RESULTS AT TIME (DAYS) 5478.606000 15y5

SPECIES .......MASS (g) IN PHASES ....

| | GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .7658E-02 | .2672E+01 | .1757E-01 | .8468E-01 |
| toluene | .9474E+02 | .1140E+06 | .1839E+03 | .3217E+04 |
| p-xylene | .2015E+03 | .8176E+06 | .4398E+03 | .2218E+05 |
| 111-trichloroethane | .6161E+02 | .1327E+06 | .4301E+03 | .4852E+04 |
| 1122-tetrachloroethane | .6501E+03 | .3241E+07 | .1615E+05 | .1413E+06 |
| 112-trichloroethane | .1225E+01 | .1069E+04 | .1040E+02 | .1095E+03 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .4410E+02 | .6412E+06 | .1674E+03 | .2378E+04 |
| trichloroethene | .1681E-01 | .7719E+01 | .1864E-01 | .1597E+00 |
| vinylacetate | .1273E-01 | .2962E+01 | .1987E-01 | .3547E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .9573E-02 | .3631E+01 | .1492E-02 | .7511E-01 |

TOTAL MASS IN ALL PHASE = .5140E+04

TOTAL MASS IN GAS PHASE (kg) = .1053E+01
TOTAL MASS IN FREE PHASE (kg) = .4947E+04
TOTAL MASS IN WATER PHASE (kg) = .1739E+02
TOTAL MASS IN SOIL PHASE (kg) = .1740E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .2726E+01 | .0000E+00 | .0000E+00 | .2513E-01 |
| toluene | .1175E+06 | .2935E+00 | .4134E+01 | .1083E+04 |
| p-xylene | .8404E+06 | .6243E+00 | .8794E+01 | .7749E+04 |
| 111-trichloroethane | .1380E+06 | .1909E+00 | .2688E+01 | .1273E+04 |
| 1122-tetrachloroethane | .3399E+07 | .2014E+01 | .2837E+02 | .3133E+05 |
| 112-trichloroethane | .1190E+04 | .3793E-02 | .5342E-01 | .1098E+02 |
| 11-dichoroethane | .5732E+01 | .0000E+00 | .0000E+00 | .5285E-01 |
| 11-dichoroethene | .2497E+01 | .0000E+00 | .0000E+00 | .2302E-01 |
| methylenechloride | .3321E+01 | .0000E+00 | .0000E+00 | .3062E-01 |
| tetrachloroethene | .6438E+06 | .1366E+00 | .1925E+01 | .5936E+04 |
| trichloroethene | .7916E+01 | .5204E-04 | .7329E-03 | .7298E-01 |
| vinylacetate | .2978E+01 | .0000E+00 | .0000E+00 | .2746E-01 |
| vinylchloride | .2067E+00 | .0000E+00 | .0000E+00 | .1906E-02 |
| Ethylbenzene | .3674E+01 | .0000E+00 | .0000E+00 | .3387E-01 |

RESULTS AT TIME (DAYS) 5478.606000

| SPECIES | .........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .7658E-02 | .2672E+01 | .1757E-01 | .8468E-01 |
| toluene | .9474E+02 | .1140E+06 | .1839E+03 | .3217E+04 |
| p-xylene | .2015E+03 | .8176E+06 | .4398E+03 | .2218E+05 |
| 111-trichloroethane | .6161E+02 | .1327E+06 | .4301E+03 | .4852E+04 |
| 1122-tetrachloroethane | .6501E+03 | .3241E+07 | .1615E+05 | .1413E+06 |
| 112-trichloroethane | .1225E+01 | .1069E+04 | .1040E+02 | .1095E+03 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .4410E+02 | .6412E+06 | .1674E+03 | .2378E+04 |
| trichloroethene | .1681E-01 | .7719E+01 | .1864E-01 | .1597E+00 |
| vinylacetate | .1273E-01 | .2962E+01 | .1987E-01 | .3547E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .9573E-02 | .3631E+01 | .1492E-02 | .7511E-01 |

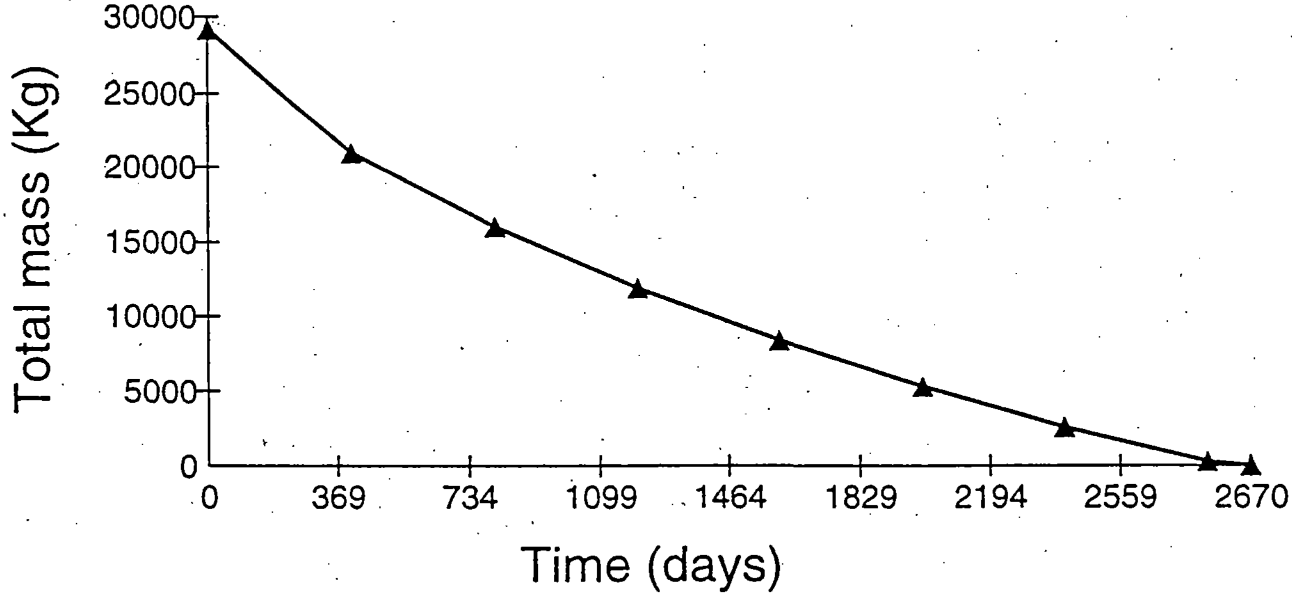
TOTAL MASS IN ALL PHASE = .5140E+04

TOTAL MASS IN GAS PHASE (kg) = .1053E+01
TOTAL MASS IN FREE PHASE (kg) = .4947E+04
TOTAL MASS IN WATER PHASE (kg) = .1739E+02
TOTAL MASS IN SOIL PHASE (kg) = .1740E+03

| SPECIES<br>S | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .2726E+01 | .0000E+00 | .0000E+00 | .2513E-01 |
| toluene | .1175E+06 | .2935E+00 | .4134E+01 | .1083E+04 |
| p-xylene | .8404E+06 | .6243E+00 | .8794E+01 | .7749E+04 |
| 111-trichloroethane | .1380E+06 | .1909E+00 | .2688E+01 | .1273E+04 |
| 1122-tetrachloroethane | .3399E+07 | .2014E+01 | .2837E+02 | .3133E+05 |
| 112-trichloroethane | .1190E+04 | .3793E-02 | .5342E-01 | .1098E+02 |
| 11-dichoroethane | .5732E+01 | .0000E+00 | .0000E+00 | .5285E-01 |
| 11-dichoroethene | .2497E+01 | .0000E+00 | .0000E+00 | .2302E-01 |
| methylenechloride | .3321E+01 | .0000E+00 | .0000E+00 | .3062E-01 |
| tetrachloroethene | .6438E+06 | .1366E+00 | .1925E+01 | .5936E+04 |
| trichloroethene | .7916E+01 | .5204E-04 | .7329E-03 | .7298E-01 |
| vinylacetate | .2978E+01 | .0000E+00 | .0000E+00 | .2746E-01 |

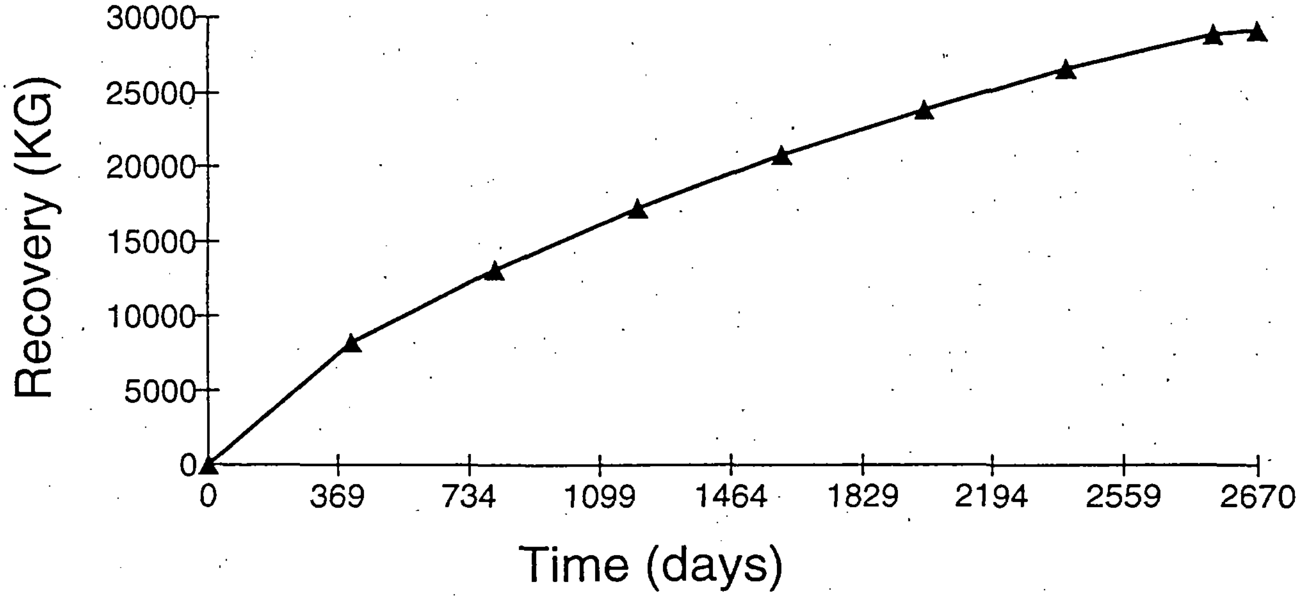
| | | | | |
|---|---|---|---|---|
| vinylchloride | .2067E+00 | .0000E+00 | .0000E+00 | .1906E-02 |
| Ethylbenzene | .3674E+01 | .0000E+00 | .0000E+00 | .3387E-01 |

ACS OFF SITE




5.2 darcy

# ACS OFF SITE



Recovery (KG)
30000
25000
20000
15000
10000
5000
0
0
369
734
1099
1464
1829
2194
2559
2670
Time (days)

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+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
+                                                               +
+                 BioSVE For Window                             +
+                                                               +
+   SOIL VACUUM EXTRACTION CHEMICAL EQUILIBRIUM MODEL           +
+      BASED ON JOHNSON ET AL. (1990) GROUND WATER              +
+                                                               +
+                                                               +
+                                                               +
+                                                               +
+                     COPYRIGHT 1995                            +
+                    ASHOK KATYAL, Ph.D.                        +
+             DRAPER ADEN ENVIRONMENTAL MODELING                +
+               BLACKSBURG, VA 24060, U.S.A.                    +
+                                                               +
+                                                               +
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
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TITLE: ACS OFF SITE

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air flow rate   (liters/day)         = .2313E+07
total mass of contaminant (g)        = .2916E+08
maximum simulation time (days)       = .5475E+04
starting time step (days)            = .5000E+00
maximum time step  (days)            = .5000E+01
time increment factor                =.10200E+01
printout time interval (days)        =.36500E+03
volumetric water content(fraction)   =.15000E+00
bulk density (g/cm^3)                =.17000E+01
foc                                  =.50000E-02
contaminated soil vol. (m^3)         =.63800E+02
temperature (C)                      =.20000E+02
intercept in free prod.recov.eqn.    =.15000E+01
exponent in free prod. recov. eqn.   =.20000E-01
bio efficiency (fraction)            =.20000E-01
residual oil mass (kg)               =.29150E+04
venting efficiency (fraction)        = .7100E-01
```

| SPECIES | VAP PRES atm | BOILING POINT deg C | SOL LIMIT ppm | KOW g/g |
|---|---|---|---|---|
| benzene | .1000E+00 | .8000E+02 | .1780E+04 | .1350E+03 |
| toluene | .2900E-01 | .1110E+03 | .5150E+03 | .4900E+03 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .8600E-02 | .1380E+03 | .1980E+03 | .1413E+04 |
| 111-trichloroethane | .1620E-01 | .7410E+02 | .1500E+04 | .3160E+03 |
| 1122-tetrachloroethane | .7000E-02 | .1462E+03 | .2900E+04 | .2450E+03 |
| 112-trichloroethane | .4000E-01 | .1138E+03 | .4500E+04 | .2950E+03 |
| 11-dichoroethane | .2400E+00 | .5750E+02 | .5500E+04 | .6170E+02 |
| 11-dichoroethene | .7900E+00 | .3700E+02 | .2250E+04 | .6920E+02 |
| methylenechloride | .4760E+00 | .9370E+02 | .2000E+04 | .2000E+02 |
| tetrachloroethene | .2400E-02 | .1210E+03 | .1500E+03 | .3980E+03 |
| trichloroethene | .7600E-01 | .8720E+02 | .1100E+04 | .2400E+03 |
| vinylacetate | .1500E+00 | .7200E+02 | .2000E+04 | .5000E+00 |
| vinylchloride | .3500E+01 | .1340E+02 | .2670E+04 | .2400E+02 |
| Ethylbenzene | .9200E-01 | .1362E+03 | .1520E+03 | .1410E+04 |
| MASS FRACTION SUM | 1.000000 | | | |

| SPECIES | MOL WEIGHT g/mol | HENRY COEFF DIMENSIONLESS |
|---|---|---|
| benzene | .7810E+02 | .0000E+00 |
| toluene | .9210E+02 | .0000E+00 |
| p-xylene | .1062E+03 | .0000E+00 |
| 111-trichloroethane | .1335E+03 | .0000E+00 |
| 1122-tetrachloroethane | .1678E+03 | .0000E+00 |
| 112-trichloroethane | .1334E+03 | .0000E+00 |
| 11-dichoroethane | .1820E+03 | .0000E+00 |
| 11-dichoroethene | .9694E+02 | .0000E+00 |
| methylenechloride | .1067E+03 | .0000E+00 |
| tetrachloroethene | .1658E+03 | .0000E+00 |
| trichloroethene | .1314E+03 | .0000E+00 |
| vinylacetate | .8600E+02 | .0000E+00 |
| vinylchloride | .6250E+02 | .0000E+00 |
| Ethylbenzene | .1067E+03 | .0000E+00 |

sgmlti 250509.200000

RESULTS AT TIME (DAYS) 0.000000E+00

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1326E+03 | .3480E+06 | .3042E+03 | .1466E+04 |
| toluene | .9595E+03 | .8682E+07 | .1862E+04 | .3258E+05 |
| p-xylene | .1019E+03 | .3108E+07 | .2223E+03 | .1121E+05 |
| 111-trichloroethane | .9489E+02 | .1537E+07 | .6625E+03 | .7473E+04 |
| 1122-tetrachloroethane | .2612E+03 | .9791E+07 | .6490E+04 | .5676E+05 |
| 112-trichloroethane | .5254E+02 | .3447E+06 | .4460E+03 | .4697E+04 |
| 11-dichoroethane | .3185E+03 | .3483E+06 | .4037E+03 | .8892E+03 |

| | | | | |
|---|---|---|---|---|
| 11-dichoroethene | .1047E+04 | .3478E+06 | .3096E+03 | .7649E+03 |
| methylenechloride | .1265E+04 | .6976E+06 | .5016E+03 | .3581E+03 |
| tetrachloroethene | .8795E+01 | .9616E+06 | .3337E+02 | .4742E+03 |
| trichloroethene | .1683E+03 | .5812E+06 | .1866E+03 | .1599E+04 |
| vinylacetate | .3495E+03 | .6114E+06 | .5454E+03 | .9735E+01 |
| vinylchloride | .7974E+04 | .5979E+06 | .3429E+04 | .2938E+04 |
| Ethylbenzene | .3668E+03 | .1046E+07 | .5718E+02 | .2878E+04 |

TOTAL MASS IN ALL PHASE = .2916E+05

TOTAL MASS IN GAS PHASE (kg) = .1310E+02
TOTAL MASS IN FREE PHASE (kg) = .2900E+05
TOTAL MASS IN WATER PHASE (kg) = .1545E+02
TOTAL MASS IN SOIL PHASE (kg) = .1241E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .3499E+06 | .0000E+00 | .0000E+00 | .3226E+04 |
| toluene | .8718E+07 | .0000E+00 | .0000E+00 | .8038E+05 |
| p-xylene | .3120E+07 | .0000E+00 | .0000E+00 | .2876E+05 |
| 111-trichloroethane | .1545E+07 | .0000E+00 | .0000E+00 | .1425E+05 |
| 1122-tetrachloroethane | .9855E+07 | .0000E+00 | .0000E+00 | .9086E+05 |
| 112-trichloroethane | .3499E+06 | .0000E+00 | .0000E+00 | .3226E+04 |
| 11-dichoroethane | .3499E+06 | .1921E-04 | .2705E-03 | .3226E+04 |
| 11-dichoroethene | .3499E+06 | .6138E-04 | .8645E-03 | .3226E+04 |
| methylenechloride | .6997E+06 | .9008E-04 | .1269E-02 | .6452E+04 |
| tetrachloroethene | .9621E+06 | .0000E+00 | .0000E+00 | .8871E+04 |
| trichloroethene | .5831E+06 | .0000E+00 | .0000E+00 | .5376E+04 |
| vinylacetate | .6123E+06 | .3630E-04 | .5113E-03 | .5645E+04 |
| vinylchloride | .6123E+06 | .4749E-03 | .6688E-02 | .5645E+04 |
| Ethylbenzene | .1050E+07 | .0000E+00 | .0000E+00 | .9677E+04 |

end of initial conditions

RESULTS AT TIME (DAYS) 368.606000

1yr

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .5545E+02 | .9794E+05 | .1272E+03 | .6131E+03 |
| toluene | .9805E+03 | .5972E+07 | .1903E+04 | .3329E+05 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .1348E+03 | .2770E+07 | .2943E+03 | .1484E+05 |
| 111-trichloroethane | .1140E+03 | .1243E+07 | .7960E+03 | .8980E+04 |
| 1122-tetrachloroethane | .3525E+03 | .8895E+07 | .8759E+04 | .7661E+05 |
| 112-trichloroethane | .4679E+02 | .2066E+06 | .3972E+03 | .4183E+04 |
| 11-dichoroethane | .2341E+02 | .1723E+05 | .2967E+02 | .6536E+02 |
| 11-dichoroethene | .1202E+00 | .2688E+02 | .3556E-01 | .8785E-01 |
| methylenechloride | .5323E+01 | .1975E+04 | .2110E+01 | .1507E+01 |
| tetrachloroethene | .1262E+02 | .9284E+06 | .4787E+02 | .6802E+03 |
| trichloroethene | .9496E+02 | .2207E+06 | .1053E+03 | .9022E+03 |
| vinylacetate | .7771E+02 | .9151E+05 | .1213E+03 | .2165E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1692E+03 | .3248E+06 | .2637E+02 | .1327E+04 |

TOTAL MASS IN ALL PHASE = .2092E+05

TOTAL MASS IN GAS PHASE (kg) = .2067E+01
TOTAL MASS IN FREE PHASE (kg) = .2077E+05
TOTAL MASS IN WATER PHASE (kg) = .1261E+02
TOTAL MASS IN SOIL PHASE (kg) = .1415E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .9875E+05 | .1716E+00 | .2417E+01 | .9104E+03 |
| toluene | .6008E+07 | .3036E+01 | .4276E+02 | .5539E+05 |
| p-xylene | .2785E+07 | .4176E+00 | .5881E+01 | .2568E+05 |
| 111-trichloroethane | .1253E+07 | .3531E+00 | .4973E+01 | .1155E+05 |
| 1122-tetrachloroethane | .8980E+07 | .1092E+01 | .1537E+02 | .8280E+05 |
| 112-trichloroethane | .2113E+06 | .1449E+00 | .2041E+01 | .1948E+04 |
| 11-dichoroethane | .1735E+05 | .7230E-01 | .1018E+01 | .1600E+03 |
| 11-dichoroethene | .2714E+02 | .3610E-03 | .5085E-02 | .2502E+00 |
| methylenechloride | .1985E+04 | .1631E-01 | .2298E+00 | .1830E+02 |
| tetrachloroethene | .9292E+06 | .3906E-01 | .5501E+00 | .8567E+04 |
| trichloroethene | .2218E+06 | .2940E+00 | .4141E+01 | .2045E+04 |
| vinylacetate | .9171E+05 | .2404E+00 | .3386E+01 | .8456E+03 |
| vinylchloride | .7730E+01 | .0000E+00 | .0000E+00 | .7128E-01 |
| Ethylbenzene | .3264E+06 | .5237E+00 | .7376E+01 | .3009E+04 |

RESULTS AT TIME (DAYS) 733.606000

2yrs

SPECIES ........MASS (g) IN PHASES ....
GAS OIL WATER SOLID

| | | | | |
|---|---|---|---|---|
| benzene | .1370E+02 | .1765E+05 | .3142E+02 | .1514E+03 |
| toluene | .8088E+03 | .3594E+07 | .1570E+04 | .2746E+05 |
| p-xylene | .1581E+03 | .2369E+07 | .3450E+03 | .1740E+05 |
| 111-trichloroethane | .1172E+03 | .9325E+06 | .8184E+03 | .9232E+04 |
| 1122-tetrachloroethane | .4244E+03 | .7814E+07 | .1055E+05 | .9224E+05 |
| 112-trichloroethane | .3219E+02 | .1037E+06 | .2733E+03 | .2878E+04 |
| 11-dichoroethane | .5666E+00 | .3043E+03 | .7181E+00 | .1582E+01 |
| 11-dichoroethene | .7289E-01 | .1189E+02 | .2156E-01 | .5326E-01 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1649E+02 | .8853E+06 | .6256E+02 | .8889E+03 |
| trichloroethene | .3505E+02 | .5945E+05 | .3887E+02 | .3330E+03 |
| vinylacetate | .8182E+01 | .7030E+04 | .1277E+02 | .2279E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .4758E+02 | .6665E+05 | .7416E+01 | .3733E+03 |

TOTAL MASS IN ALL PHASE = .1602E+05

TOTAL MASS IN GAS PHASE (kg) = .1662E+01
TOTAL MASS IN FREE PHASE (kg) = .1585E+05
TOTAL MASS IN WATER PHASE (kg) = .1371E+02
TOTAL MASS IN SOIL PHASE (kg) = .1510E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .1785E+05 | .4247E-01 | .5981E+00 | .1646E+03 |
| toluene | .3624E+07 | .2508E+01 | .3532E+02 | .3341E+05 |
| p-xylene | .2387E+07 | .4901E+00 | .6903E+01 | .2201E+05 |
| 111-trichloroethane | .9427E+06 | .3634E+00 | .5118E+01 | .8691E+04 |
| 1122-tetrachloroethane | .7917E+07 | .1316E+01 | .1853E+02 | .7300E+05 |
| 112-trichloroethane | .1069E+06 | .9980E-01 | .1406E+01 | .9856E+03 |
| 11-dichoroethane | .3072E+03 | .1757E-02 | .2475E-01 | .2832E+01 |
| 11-dichoroethene | .1189E+02 | .0000E+00 | .0000E+00 | .1096E+00 |
| methylenechloride | .1196E+02 | .0000E+00 | .0000E+00 | .1103E+00 |
| tetrachloroethene | .8863E+06 | .5111E-01 | .7199E+00 | .8172E+04 |
| trichloroethene | .5985E+05 | .1087E+00 | .1531E+01 | .5519E+03 |
| vinylacetate | .7052E+04 | .2537E-01 | .3573E+00 | .6501E+02 |
| vinylchloride | .7688E+01 | .0000E+00 | .0000E+00 | .7089E-01 |
| Ethylbenzene | .6708E+05 | .1475E+00 | .2078E+01 | .6185E+03 |

RESULTS AT TIME (DAYS) 1098.606000

3 yrs

| SPECIES | .........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1819E+01 | .1654E+04 | .4174E+01 | .2012E+02 |
| toluene | .5670E+03 | .1777E+07 | .1100E+04 | .1925E+05 |
| p-xylene | .1804E+03 | .1907E+07 | .3937E+03 | .1986E+05 |
| 111-trichloroethane | .1115E+03 | .6259E+06 | .7786E+03 | .8784E+04 |
| 1122-tetrachloroethane | .5027E+03 | .6529E+07 | .1249E+05 | .1093E+06 |
| 112-trichloroethane | .1765E+02 | .4013E+05 | .1499E+03 | .1578E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2188E+02 | .8289E+06 | .8303E+02 | .1180E+04 |
| trichloroethene | .8079E+01 | .9665E+04 | .8958E+01 | .7676E+02 |
| vinylacetate | .3338E+00 | .2023E+03 | .5210E+00 | .9300E-02 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .7532E+01 | .7444E+04 | .1174E+01 | .5910E+02 |

TOTAL MASS IN ALL PHASE = .1190E+05

TOTAL MASS IN GAS PHASE (kg) = .1419E+01
TOTAL MASS IN FREE PHASE (kg) = .1173E+05
TOTAL MASS IN WATER PHASE (kg) = .1501E+02
TOTAL MASS IN SOIL PHASE (kg) = .1601E+03

| SPECIES S | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .1680E+04 | .5640E-02 | .7944E-01 | .1549E+02 |
| toluene | .1798E+07 | .1758E+01 | .2475E+02 | .1658E+05 |
| p-xylene | .1927E+07 | .5592E+00 | .7876E+01 | .1777E+05 |
| 111-trichloroethane | .6355E+06 | .3457E+00 | .4869E+01 | .5860E+04 |
| 1122-tetrachloroethane | .6651E+07 | .1558E+01 | .2195E+02 | .6132E+05 |
| 112-trichloroethane | .4187E+05 | .5472E-01 | .7707E+00 | .3861E+03 |
| 11-dichoroethane | .1529E+02 | .0000E+00 | .0000E+00 | .1410E+00 |
| 11-dichoroethene | .6593E+01 | .0000E+00 | .0000E+00 | .6079E-01 |
| methylenechloride | .8421E+01 | .0000E+00 | .0000E+00 | .7764E-01 |
| tetrachloroethene | .8302E+06 | .6783E-01 | .9554E+00 | .7654E+04 |
| trichloroethene | .9759E+04 | .2505E-01 | .3528E+00 | .8998E+02 |
| vinylacetate | .2032E+03 | .1035E-02 | .1458E-01 | .1874E+01 |
| vinylchloride | .1841E+00 | .0000E+00 | .0000E+00 | .1698E-02 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .7512E+04 | .2335E-01 | .3289E+00 | .6926E+02 |

RESULTS AT TIME (DAYS) 1463.606000

4 yrs

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .9018E-01 | .5439E+02 | .2069E+00 | .9971E+00 |
| toluene | .3074E+03 | .6393E+06 | .5966E+03 | .1044E+05 |
| p-xylene | .1983E+03 | .1391E+07 | .4327E+03 | .2183E+05 |
| 111-trichloroethane | .9419E+02 | .3507E+06 | .6576E+03 | .7419E+04 |
| 1122-tetrachloroethane | .5834E+03 | .5027E+07 | .1450E+05 | .1268E+06 |
| 112-trichloroethane | .6802E+01 | .1026E+05 | .5775E+02 | .6082E+03 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2997E+02 | .7532E+06 | .1137E+03 | .1616E+04 |
| trichloroethene | .8776E+00 | .6964E+03 | .9731E+00 | .8337E+01 |
| vinylacetate | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .4764E+00 | .3123E+03 | .7425E-01 | .3738E+01 |

TOTAL MASS IN ALL PHASE = .8358E+04

TOTAL MASS IN GAS PHASE (kg) = .1222E+01
TOTAL MASS IN FREE PHASE (kg) = .8172E+04
TOTAL MASS IN WATER PHASE (kg) = .1636E+02
TOTAL MASS IN SOIL PHASE (kg) = .1687E+03

| SPECIES S | MASS g | CONC WELL GAS g/m3 | CONC SOIL GAS g/m3 | CONC SOIL MAS mg/k g |
|---|---|---|---|---|
| benzene | .5569E+02 | .2795E-03 | .3937E-02 | .5135E+00 |
| toluene | .6506E+06 | .9526E+00 | .1342E+02 | .5999E+04 |
| p-xylene | .1413E+07 | .6145E+00 | .8655E+01 | .1303E+05 |
| 111-trichloroethane | .3588E+06 | .2919E+00 | .4111E+01 | .3308E+04 |
| 1122-tetrachloroethane | .5168E+07 | .1808E+01 | .2547E+02 | .4765E+05 |
| 112-trichloroethane | .1093E+05 | .2108E-01 | .2969E+00 | .1008E+03 |
| 11-dichoroethane | .9199E+01 | .0000E+00 | .0000E+00 | .8481E-01 |
| 11-dichoroethene | .3917E+01 | .0000E+00 | .0000E+00 | .3612E-01 |
| methylenechloride | .4876E+01 | .0000E+00 | .0000E+00 | .4496E-01 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .7550E+06 | .9289E-01 | .1308E+01 | .6961E+04 |
| trichloroethene | .7067E+03 | .2720E-02 | .3831E-01 | .6516E+01 |
| vinylacetate | .4736E+01 | .0000E+00 | .0000E+00 | .4367E-01 |
| vinylchloride | .1823E+00 | .0000E+00 | .0000E+00 | .1681E-02 |
| Ethylbenzene | .3166E+03 | .1477E-02 | .2080E-01 | .2919E+01 |

RESULTS AT TIME (DAYS) 1828.606000

5 yrs

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .1036E+03 | .1286E+06 | .2010E+03 | .3516E+04 |
| p-xylene | .2018E+03 | .8452E+06 | .4404E+03 | .2221E+05 |
| 111-trichloroethane | .6354E+02 | .1413E+06 | .4436E+03 | .5005E+04 |
| 1122-tetrachloroethane | .6470E+03 | .3329E+07 | .1608E+05 | .1406E+06 |
| 112-trichloroethane | .1400E+01 | .1260E+04 | .1188E+02 | .1251E+03 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .4315E+02 | .6476E+06 | .1637E+03 | .2327E+04 |
| trichloroethene | .2431E-01 | .1152E+02 | .2696E-01 | .2310E+00 |
| vinylacetate | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

TOTAL MASS IN ALL PHASE = .5286E+04

TOTAL MASS IN GAS PHASE (kg) = .1061E+01
TOTAL MASS IN FREE PHASE (kg) = .5093E+04
TOTAL MASS IN WATER PHASE (kg) = .1734E+02
TOTAL MASS IN SOIL PHASE (kg) = .1738E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .2566E+01 | .0000E+00 | .0000E+00 | .2366E-01 |
| toluene | .1324E+06 | .3207E+00 | .4517E+01 | .1221E+04 |
| p-xylene | .8680E+06 | .6250E+00 | .8803E+01 | .8003E+04 |
| 111-trichloroethane | .1468E+06 | .1968E+00 | .2772E+01 | .1353E+04 |
| 1122-tetrachloroethane | .3486E+07 | .2004E+01 | .2823E+02 | .3214E+05 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .1399E+04 | .4333E-02 | .6104E-01 | .1290E+02 |
| 11-dichoroethane | .6091E+01 | .0000E+00 | .0000E+00 | .5616E-01 |
| 11-dichoroethene | .1247E+01 | .0000E+00 | .0000E+00 | .1149E-01 |
| methylenechloride | .3084E+01 | .0000E+00 | .0000E+00 | .2843E-01 |
| tetrachloroethene | .6502E+06 | .1337E+00 | .1882E+01 | .5994E+04 |
| trichloroethene | .1181E+02 | .7534E-04 | .1061E-02 | .1089E+00 |
| vinylacetate | .2918E+01 | .0000E+00 | .0000E+00 | .2690E-01 |
| vinylchloride | .1796E+00 | .0000E+00 | .0000E+00 | .1656E-02 |
| Ethylbenzene | .3431E+01 | .0000E+00 | .0000E+00 | .3163E-01 |

RESULTS AT TIME (DAYS) 2193.606000

6 yrs

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .1173E+02 | .6586E+04 | .2277E+02 | .3983E+03 |
| p-xylene | .1748E+03 | .3309E+06 | .3815E+03 | .1924E+05 |
| 111-trichloroethane | .2593E+02 | .2606E+05 | .1810E+03 | .2042E+04 |
| 1122-tetrachloroethane | .6589E+03 | .1533E+07 | .1637E+05 | .1432E+06 |
| 112-trichloroethane | .7555E-01 | .3075E+02 | .6413E+00 | .6754E+01 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .8622E-01 | .2949E+01 | .3418E-01 | .2440E-01 |
| tetrachloroethene | .7167E+02 | .4862E+06 | .2719E+03 | .3864E+04 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .1409E-01 | .1530E+01 | .2199E-01 | .3926E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

TOTAL MASS IN ALL PHASE = .2569E+04

TOTAL MASS IN GAS PHASE (kg) = .9432E+00
TOTAL MASS IN FREE PHASE (kg) = .2382E+04
TOTAL MASS IN WATER PHASE (kg) = .1723E+02
TOTAL MASS IN SOIL PHASE (kg) = .1688E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .1181E+01 | .0000E+00 | .0000E+00 | .1088E-01 |

| | | | | |
|---|---|---|---|---|
| toluene | .7019E+04 | .3634E-01 | .5119E+00 | .6472E+02 |
| p-xylene | .3507E+06 | .5417E+00 | .7629E+01 | .3233E+04 |
| 111-trichloroethane | .2831E+05 | .8035E-01 | .1132E+01 | .2610E+03 |
| 1122-tetrachloroethane | .1692E+07 | .2042E+01 | .2876E+02 | .1560E+05 |
| 112-trichloroethane | .3823E+02 | .2340E-03 | .3295E-02 | .3525E+00 |
| 11-dichoroethane | .1504E+01 | .0000E+00 | .0000E+00 | .1386E-01 |
| 11-dichoroethene | .1214E+01 | .0000E+00 | .0000E+00 | .1119E-01 |
| methylenechloride | .3003E+01 | .0000E+00 | .0000E+00 | .2769E-01 |
| tetrachloroethene | .4904E+06 | .2220E+00 | .3127E+01 | .4521E+04 |
| trichloroethene | .1917E+01 | .0000E+00 | .0000E+00 | .1768E-01 |
| vinylacetate | .1543E+01 | .0000E+00 | .0000E+00 | .1423E-01 |
| vinylchloride | .1749E+00 | .0000E+00 | .0000E+00 | .1613E-02 |
| Ethylbenzene | .1351E+01 | .2920E-04 | .4112E-03 | .1246E-01 |

RESULTS AT TIME (DAYS) 2558.606000 7yrs

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .9776E-02 | .3857E+00 | .1898E-01 | .3319E+00 |
| p-xylene | .4319E+02 | .5746E+04 | .9425E+02 | .4754E+04 |
| 111-trichloroethane | .6634E+00 | .4685E+02 | .4632E+01 | .5225E+02 |
| 1122-tetrachloroethane | .3378E+03 | .5521E+05 | .8393E+04 | .7341E+05 |
| 112-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2456E+03 | .1171E+06 | .9320E+03 | .1324E+05 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

TOTAL MASS IN ALL PHASE = .2796E+03

TOTAL MASS IN GAS PHASE (kg) = .6272E+00
TOTAL MASS IN FREE PHASE (kg) = .1781E+03
TOTAL MASS IN WATER PHASE (kg) = .9424E+01
TOTAL MASS IN SOIL PHASE (kg) = .9146E+02

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|

S

| | g | g/m3 | g/m3 | mg/kg |
|---|---|---|---|---|
| benzene | .6097E-01 | .0000E+00 | .0000E+00 | .5622E-03 |
| toluene | .5058E+00 | .0000E+00 | .0000E+00 | .4663E-02 |
| p-xylene | .1061E+05 | .1332E+00 | .1876E+01 | .9787E+02 |
| 111-trichloroethane | .9321E+02 | .1440E-02 | .2028E-01 | .8594E+00 |
| 1122-tetrachloroethane | .1365E+06 | .1031E+01 | .1453E+02 | .1258E+04 |
| 112-trichloroethane | .1606E+00 | .0000E+00 | .0000E+00 | .1481E-02 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1315E+06 | .7602E+00 | .1071E+02 | .1212E+04 |
| trichloroethene | .1381E+00 | .0000E+00 | .0000E+00 | .1274E-02 |
| vinylacetate | .8717E-02 | .0000E+00 | .0000E+00 | .8037E-04 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

no free oil after time (days) 2601.106000

RESULTS AT TIME (DAYS) 2669.888000

Days

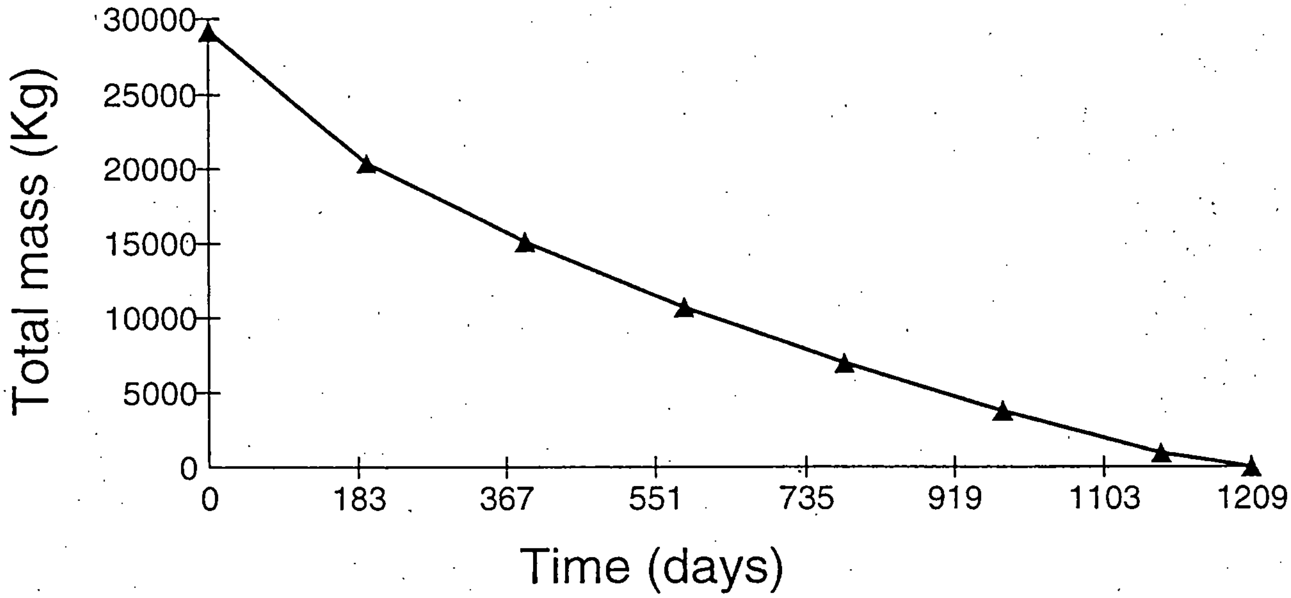
| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| p-xylene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 111-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 1122-tetrachloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 112-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

TOTAL MASS IN ALL PHASE = .0000E+00

TOTAL MASS IN GAS PHASE (kg) = .0000E+00
TOTAL MASS IN FREE PHASE (kg) = .0000E+00
TOTAL MASS IN WATER PHASE (kg) = .0000E+00
TOTAL MASS IN SOIL PHASE (kg) = .0000E+00

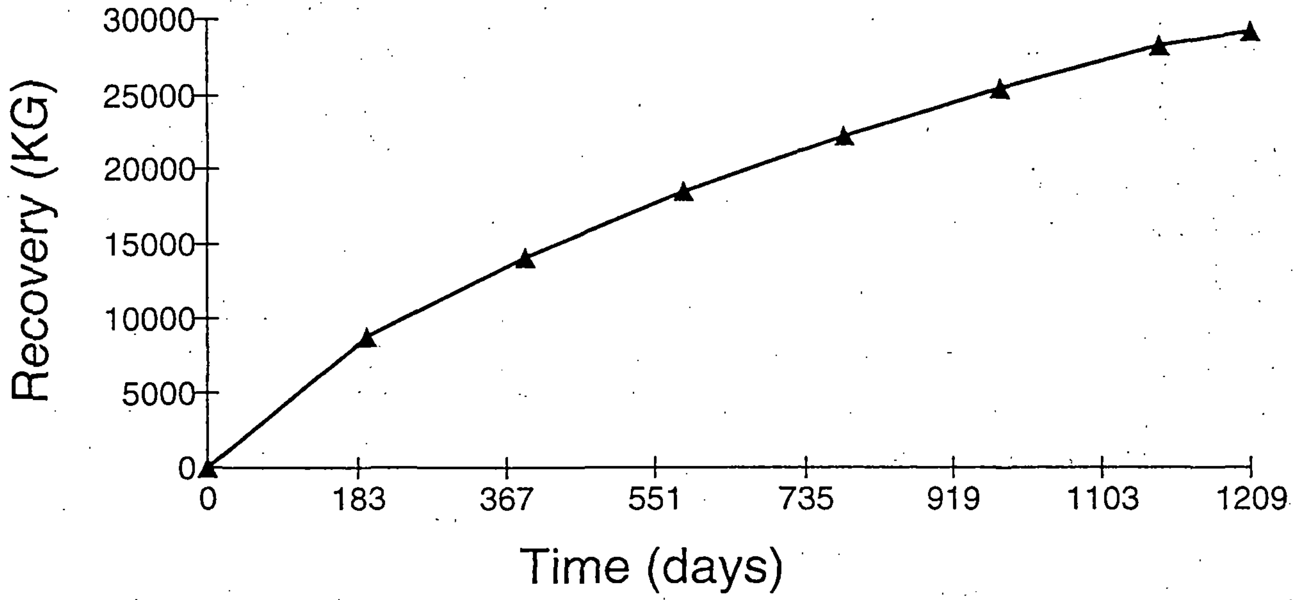
| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| p-xylene | .0000E+00 | .7507E-04 | .1057E-02 | .0000E+00 |
| 111-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 1122-tetrachloroethane | .0000E+00 | .2583E-01 | .3638E+00 | .0000E+00 |
| 112-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .0000E+00 | .1032E-04 | .1453E-03 | .0000E+00 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

# ACS OFF SITE




10 darcy

# ACS OFF SITE



Recovery (KG)
30000
25000
20000
15000
10000
5000
0
0
183
367
551
735
919
1103
1209
Time (days)

```
[HEADER]
FILETYPE=
PROJECT_TITLE=ACS OFF SITE
PROJECT_FILE=C:\DAEM\BIOSVE\ASCOFF.SPF
PROJECT_SPECIES_FILE=C:\DAEM\BIOSVE\ASCOFF.SSF
NUMERICAL_MODEL=BIOSVE.PIF
MODEL_INPUT_FILE=C:\DAEM\BIOSVE\ASCOFF.DAT
MODEL_OUTPUT_FILE=C:\DAEM\BIOSVE\ASCOFF.OUT
MODEL_SPECIES_FILE=C:\DAEM\BIOSVE\ASCOFF.SPC
MODEL_ERROR_FILE=C:\DAEM\BIOSVE\ASCOFF.ERR
PREPROCESSOR_VERSION=
NUMERICAL_MODEL_VERSION=

[CONTROL_PARAMETERS]
NTSP=14
IFOUR=1
HSMT=29156
Q=125.6
DELT=0.5
DTMX=5
TFACT=1.02
TMAX=5475
TPNT=180
TEMP=20
ETA=0.071
SOILV=63.8
WC=0.15
RHOB=1.7
FOC=0.005
HIN=1.5
HEX=0.02
EBIO=0.02
HRES=2915
```

```
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80.0000   1780.0000 135.0000
'toluene'                                        0.2990    92.1000   0.0290
111.0000  515.0000  490.0000
'p-xylene'                                       0.1070    106.2000  0.0086
138.0000  198.0000  1413.0000
'111-trichloroethane'                            0.0530    133.5000  0.0162
74.1000   1500.0000 316.0000
'1122-tetrachloroethane'                         0.3380    167.8300  0.0070
146.2000  2900.0000 245.0000
'112-trichloroethane'                            0.0120    133.4000  0.0400
113.8000  4500.0000 295.0000
'11-dichoroethane'                               0.0120    182.0000  0.2400
57.5000   5500.0000 61.7000
'11-dichoroethene'                               0.0120    96.9400   0.7900
37.0000   2250.0000 69.2000
'methylenechloride'                              0.0240    106.7000  0.4760
93.7000   2000.0000 20.0000
'tetrachloroethene'                              0.0330    165.8000  0.0024
121.0000  150.0000  398.0000
'trichloroethene'                                0.0200    131.4000  0.0760
87.2000   1100.0000 240.0000
'vinylacetate'                                   0.0210    86.0000   0.1500
72.0000   2000.0000 0.5000
'vinylchloride'                                  0.0210    62.5000   3.5000
13.4000   2670.0000 24.0000
'Ethylbenzene'                                   0.0360    106.7000  0.0920
136.2000  152.0000  1410.0000
```

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+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
+                                                                +
+                    BioSVE For Window                           +
+                                                                +
+   SOIL VACUUM EXTRACTION CHEMICAL EQUILIBRIUM MODEL            +
+      BASED ON JOHNSON ET AL. (1990) GROUND WATER               +
+                                                                +
+                                                                +
+                                                                +
+                                                                +
+                      COPYRIGHT 1995                            +
+                    ASHOK KATYAL, Ph.D.                         +
+              DRAPER ADEN ENVIRONMENTAL MODELING                +
+                BLACKSBURG, VA 24060, U.S.A.                    +
+                                                                +
+                                                                +
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
```

TITLE: ACS OFF SITE

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air flow rate   (liters/day)          = .5118E+07
total mass of contaminant (g)         = .2916E+08
maximum simulation time (days)        = .5475E+04
starting time step (days)             = .5000E+00
maximum time step  (days)             = .5000E+01
time increment factor                 =.10200E+01
printout time interval (days)         =.18000E+03
volumetric water content(fraction)    =.15000E+00
bulk density (g/cm^3)                 =.17000E+01
foc                                   =.50000E-02
contaminated soil vol. (m^3)          =.63800E+02
temperature (C)                       =.20000E+02
intercept in free prod.recov.eqn.     =.15000E+01
exponent in free prod. recov. eqn.    =.20000E-01
bio efficiency (fraction)             =.20000E-01
residual oil mass (kg)                =.29150E+04
venting efficiency (fraction)         = .7100E-01
```

| SPECIES | VAP PRES atm | BOILING POINT deg C | SOL LIMIT ppm | KOW g/g |
|---|---|---|---|---|
| benzene | .1000E+00 | .8000E+02 | .1780E+04 | .1350E+03 |
| toluene | .2900E-01 | .1110E+03 | .5150E+03 | .4900E+03 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .8600E-02 | .1380E+03 | .1980E+03 | .1413E+04 |
| 111-trichloroethane | .1620E-01 | .7410E+02 | .1500E+04 | .3160E+03 |
| 1122-tetrachloroethane | .7000E-02 | .1462E+03 | .2900E+04 | .2450E+03 |
| 112-trichloroethane | .4000E-01 | .1138E+03 | .4500E+04 | .2950E+03 |
| 11-dichoroethane | .2400E+00 | .5750E+02 | .5500E+04 | .6170E+02 |
| 11-dichoroethene | .7900E+00 | .3700E+02 | .2250E+04 | .6920E+02 |
| methylenechloride | .4760E+00 | .9370E+02 | .2000E+04 | .2000E+02 |
| tetrachloroethene | .2400E-02 | .1210E+03 | .1500E+03 | .3980E+03 |
| trichloroethene | .7600E-01 | .8720E+02 | .1100E+04 | .2400E+03 |
| vinylacetate | .1500E+00 | .7200E+02 | .2000E+04 | .5000E+00 |
| vinylchloride | .3500E+01 | .1340E+02 | .2670E+04 | .2400E+02 |
| Ethylbenzene | .9200E-01 | .1362E+03 | .1520E+03 | .1410E+04 |
| MASS FRACTION SUM | 1.000000 | | | |

| SPECIES | MOL WEIGHT g/mol | HENRY COEFF DIMENSIONLESS |
|---|---|---|
| benzene | .7810E+02 | .0000E+00 |
| toluene | .9210E+02 | .0000E+00 |
| p-xylene | .1062E+03 | .0000E+00 |
| 111-trichloroethane | .1335E+03 | .0000E+00 |
| 1122-tetrachloroethane | .1678E+03 | .0000E+00 |
| 112-trichloroethane | .1334E+03 | .0000E+00 |
| 11-dichoroethane | .1820E+03 | .0000E+00 |
| 11-dichoroethene | .9694E+02 | .0000E+00 |
| methylenechloride | .1067E+03 | .0000E+00 |
| tetrachloroethene | .1658E+03 | .0000E+00 |
| trichloroethene | .1314E+03 | .0000E+00 |
| vinylacetate | .8600E+02 | .0000E+00 |
| vinylchloride | .6250E+02 | .0000E+00 |
| Ethylbenzene | .1067E+03 | .0000E+00 |

sgmlti 250509.200000

RESULTS AT TIME (DAYS) 0.000000E+00

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1326E+03 | .3480E+06 | .3042E+03 | .1466E+04 |
| toluene | .9595E+03 | .8682E+07 | .1862E+04 | .3258E+05 |
| p-xylene | .1019E+03 | .3108E+07 | .2223E+03 | .1121E+05 |
| 111-trichloroethane | .9489E+02 | .1537E+07 | .6625E+03 | .7473E+04 |
| 1122-tetrachloroethane | .2612E+03 | .9791E+07 | .6490E+04 | .5676E+05 |
| 112-trichloroethane | .5254E+02 | .3447E+06 | .4460E+03 | .4697E+04 |
| 11-dichoroethane | .3185E+03 | .3483E+06 | .4037E+03 | .8892E+03 |

| | | | | |
|---|---|---|---|---|
| 11-dichoroethene | .1047E+04 | .3478E+06 | .3096E+03 | .7649E+03 |
| methylenechloride | .1265E+04 | .6976E+06 | .5016E+03 | .3581E+03 |
| tetrachloroethene | .8795E+01 | .9616E+06 | .3337E+02 | .4742E+03 |
| trichloroethene | .1683E+03 | .5812E+06 | .1866E+03 | .1599E+04 |
| vinylacetate | .3495E+03 | .6114E+06 | .5454E+03 | .9735E+01 |
| vinylchloride | .7974E+04 | .5979E+06 | .3429E+04 | .2938E+04 |
| Ethylbenzene | .3668E+03 | .1046E+07 | .5718E+02 | .2878E+04 |

TOTAL MASS IN ALL PHASE = .2916E+05

TOTAL MASS IN GAS PHASE (kg) = .1310E+02
TOTAL MASS IN FREE PHASE (kg) = .2900E+05
TOTAL MASS IN WATER PHASE (kg) = .1545E+02
TOTAL MASS IN SOIL PHASE (kg) = .1241E+03

| SPECIES<br>S | MASS<br>g | CONC WELL GAS<br>g/m3 | CONC SOIL GAS<br>g/m3 | CONC SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .3499E+06 | .1490E-04 | .2099E-03 | .3226E+04 |
| toluene | .8718E+07 | .0000E+00 | .0000E+00 | .8038E+05 |
| p-xylene | .3120E+07 | .0000E+00 | .0000E+00 | .2876E+05 |
| 111-trichloroethane | .1545E+07 | .0000E+00 | .0000E+00 | .1425E+05 |
| 1122-tetrachloroethane | .9855E+07 | .0000E+00 | .0000E+00 | .9086E+05 |
| 112-trichloroethane | .3499E+06 | .0000E+00 | .0000E+00 | .3226E+04 |
| 11-dichoroethane | .3499E+06 | .1736E-04 | .2445E-03 | .3226E+04 |
| 11-dichoroethene | .3499E+06 | .6473E-04 | .9117E-03 | .3226E+04 |
| methylenechloride | .6997E+06 | .8143E-04 | .1147E-02 | .6452E+04 |
| tetrachloroethene | .9621E+06 | .0000E+00 | .0000E+00 | .8871E+04 |
| trichloroethene | .5831E+06 | .0000E+00 | .0000E+00 | .5376E+04 |
| vinylacetate | .6123E+06 | .1641E-04 | .2311E-03 | .5645E+04 |
| vinylchloride | .6123E+06 | .5008E-03 | .7054E-02 | .5645E+04 |
| Ethylbenzene | .1050E+07 | .4072E-04 | .5735E-03 | .9677E+04 |

end of initial conditions

RESULTS AT TIME (DAYS) 183.045300

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .4946E+02 | .8472E+05 | .1135E+03 | .5469E+03 |
| toluene | .9678E+03 | .5717E+07 | .1878E+04 | .3286E+05 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .1372E+03 | .2732E+07 | .2994E+03 | .1510E+05 |
| 111-trichloroethane | .1147E+03 | .1213E+07 | .8007E+03 | .9033E+04 |
| 1122-tetrachloroethane | .3594E+03 | .8796E+07 | .8932E+04 | .7812E+05 |
| 112-trichloroethane | .4547E+02 | .1947E+06 | .3860E+03 | .4066E+04 |
| 11-dichoroethane | .1732E+02 | .1236E+05 | .2196E+02 | .4836E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .2948E+01 | .1061E+04 | .1169E+01 | .8344E+00 |
| tetrachloroethene | .1296E+02 | .9246E+06 | .4916E+02 | .6985E+03 |
| trichloroethene | .8758E+02 | .1974E+06 | .9711E+02 | .8321E+03 |
| vinylacetate | .6466E+02 | .7384E+05 | .1009E+03 | .1801E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1525E+03 | .2840E+06 | .2378E+02 | .1197E+04 |

TOTAL MASS IN ALL PHASE = .2039E+05

TOTAL MASS IN GAS PHASE (kg) = .2012E+01
TOTAL MASS IN FREE PHASE (kg) = .2023E+05
TOTAL MASS IN WATER PHASE (kg) = .1270E+02
TOTAL MASS IN SOIL PHASE (kg) = .1425E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .8544E+05 | .1502E+00 | .2116E+01 | .7877E+03 |
| toluene | .5752E+07 | .2939E+01 | .4140E+02 | .5304E+05 |
| p-xylene | .2748E+07 | .4166E+00 | .5868E+01 | .2534E+05 |
| 111-trichloroethane | .1223E+07 | .3483E+00 | .4906E+01 | .1127E+05 |
| 1122-tetrachloroethane | .8883E+07 | .1092E+01 | .1538E+02 | .8190E+05 |
| 112-trichloroethane | .1992E+06 | .1381E+00 | .1945E+01 | .1837E+04 |
| 11-dichoroethane | .1245E+05 | .5267E-01 | .7418E+00 | .1148E+03 |
| 11-dichoroethene | .1550E+02 | .0000E+00 | .0000E+00 | .1430E+00 |
| methylenechloride | .1066E+04 | .9020E-02 | .1270E+00 | .9829E+01 |
| tetrachloroethene | .9254E+06 | .3934E-01 | .5541E+00 | .8532E+04 |
| trichloroethene | .1984E+06 | .2660E+00 | .3747E+01 | .1829E+04 |
| vinylacetate | .7401E+05 | .1964E+00 | .2767E+01 | .6824E+03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2854E+06 | .4634E+00 | .6526E+01 | .2631E+04 |

RESULTS AT TIME (DAYS) 367.263000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |

| | | | | |
|---|---|---|---|---|
| benzene | .9653E+01 | .1159E+05 | .2215E+02 | .1067E+03 |
| toluene | .7613E+03 | .3152E+07 | .1478E+04 | .2585E+05 |
| p-xylene | .1629E+03 | .2274E+07 | .3555E+03 | .1793E+05 |
| 111-trichloroethane | .1167E+03 | .8651E+06 | .8150E+03 | .9194E+04 |
| 1122-tetrachloroethane | .4404E+03 | .7553E+07 | .1094E+05 | .9572E+05 |
| 112-trichloroethane | .2897E+02 | .8693E+05 | .2459E+03 | .2590E+04 |
| 11-dichoroethane | .2481E+00 | .1241E+03 | .3145E+00 | .6927E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .6819E-01 | .1720E+02 | .2703E-01 | .1930E-01 |
| tetrachloroethene | .1748E+02 | .8744E+06 | .6633E+02 | .9425E+03 |
| trichloroethene | .2711E+02 | .4282E+05 | .3006E+02 | .2575E+03 |
| vinylacetate | .4782E+01 | .3827E+04 | .7463E+01 | .1332E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3453E+02 | .4506E+05 | .5383E+01 | .2709E+03 |

TOTAL MASS IN ALL PHASE = .1508E+05

TOTAL MASS IN GAS PHASE (kg) = .1604E+01
TOTAL MASS IN FREE PHASE (kg) = .1491E+05
TOTAL MASS IN WATER PHASE (kg) = .1397E+02
TOTAL MASS IN SOIL PHASE (kg) = .1529E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .1173E+05 | .2993E-01 | .4215E+00 | .1081E+03 |
| toluene | .3180E+07 | .2360E+01 | .3324E+02 | .2932E+05 |
| p-xylene | .2292E+07 | .5050E+00 | .7112E+01 | .2113E+05 |
| 111-trichloroethane | .8752E+06 | .3619E+00 | .5097E+01 | .8069E+04 |
| 1122-tetrachloroethane | .7660E+07 | .1365E+01 | .1923E+02 | .7063E+05 |
| 112-trichloroethane | .8979E+05 | .8980E-01 | .1265E+01 | .8279E+03 |
| 11-dichoroethane | .1254E+03 | .7687E-03 | .1083E-01 | .1156E+01 |
| 11-dichoroethene | .1041E+02 | .0000E+00 | .0000E+00 | .9602E-01 |
| methylenechloride | .1724E+02 | .0000E+00 | .0000E+00 | .1590E+00 |
| tetrachloroethene | .8754E+06 | .5419E-01 | .7632E+00 | .8071E+04 |
| trichloroethene | .4313E+05 | .8405E-01 | .1184E+01 | .3977E+03 |
| vinylacetate | .3840E+04 | .1483E-01 | .2088E+00 | .3540E+02 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .4537E+05 | .1071E+00 | .1508E+01 | .4183E+03 |

RESULTS AT TIME (DAYS) 551.251300

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .8334E+00 | .6675E+03 | .1912E+01 | .9215E+01 |
| toluene | .4816E+03 | .1330E+07 | .9347E+03 | .1635E+05 |
| p-xylene | .1869E+03 | .1741E+07 | .4080E+03 | .2058E+05 |
| 111-trichloroethane | .1072E+03 | .5300E+06 | .7485E+03 | .8444E+04 |
| 1122-tetrachloroethane | .5292E+03 | .6054E+07 | .1315E+05 | .1150E+06 |
| 112-trichloroethane | .1363E+02 | .2730E+05 | .1157E+03 | .1219E+04 |
| 11-dichoroethane | .4839E-01 | .1615E+02 | .6133E-01 | .1351E+00 |
| 11-dichoroethene | .1011E+00 | .1025E+02 | .2990E-01 | .7386E-01 |
| methylenechloride | .7874E-01 | .1325E+02 | .3121E-01 | .2228E-01 |
| tetrachloroethene | .2416E+02 | .8063E+06 | .9169E+02 | .1303E+04 |
| trichloroethene | .4491E+01 | .4733E+04 | .4980E+01 | .4267E+02 |
| vinylacetate | .1039E+00 | .5550E+02 | .1622E+00 | .2896E-02 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3663E+01 | .3188E+04 | .5709E+00 | .2874E+02 |

TOTAL MASS IN ALL PHASE = .1068E+05

TOTAL MASS IN GAS PHASE (kg) = .1352E+01
TOTAL MASS IN FREE PHASE (kg) = .1050E+05
TOTAL MASS IN WATER PHASE (kg) = .1546E+02
TOTAL MASS IN SOIL PHASE (kg) = .1630E+03

| SPECIES<br>S | MASS<br>g | CONC WELL GAS<br>g/m3 | CONC SOIL GAS<br>g/m3 | CONC SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .6795E+03 | .2583E-02 | .3638E-01 | .6265E+01 |
| toluene | .1348E+07 | .1493E+01 | .2102E+02 | .1243E+05 |
| p-xylene | .1762E+07 | .5794E+00 | .8161E+01 | .1625E+05 |
| 111-trichloroethane | .5393E+06 | .3323E+00 | .4680E+01 | .4972E+04 |
| 1122-tetrachloroethane | .6182E+07 | .1640E+01 | .2310E+02 | .5700E+05 |
| 112-trichloroethane | .2865E+05 | .4226E-01 | .5952E+00 | .2641E+03 |
| 11-dichoroethane | .1624E+02 | .0000E+00 | .0000E+00 | .1497E+00 |
| 11-dichoroethene | .1032E+02 | .0000E+00 | .0000E+00 | .9518E-01 |
| methylenechloride | .1330E+02 | .0000E+00 | .0000E+00 | .1226E+00 |
| tetrachloroethene | .8077E+06 | .7489E-01 | .1055E+01 | .7447E+04 |
| trichloroethene | .4785E+04 | .1392E-01 | .1961E+00 | .4412E+02 |
| vinylacetate | .5577E+02 | .3221E-03 | .4536E-02 | .5142E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .3222E+04 | .1135E-01 | .1599E+00 | .2970E+02 |

RESULTS AT TIME (DAYS) 735.239600

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1770E-01 | .8646E+01 | .4062E-01 | .1958E+00 |
| toluene | .2075E+03 | .3494E+06 | .4027E+03 | .7044E+04 |
| p-xylene | .2022E+03 | .1148E+07 | .4412E+03 | .2226E+05 |
| 111-trichloroethane | .8217E+02 | .2477E+06 | .5737E+03 | .6472E+04 |
| 1122-tetrachloroethane | .6147E+03 | .4289E+07 | .1527E+05 | .1336E+06 |
| 112-trichloroethane | .3822E+01 | .4666E+04 | .3244E+02 | .3417E+03 |
| 11-dichoroethane | .6214E-01 | .1264E+02 | .7876E-01 | .1735E+00 |
| 11-dichoroethene | .1629E+00 | .1007E+02 | .4817E-01 | .1190E+00 |
| methylenechloride | .1272E+00 | .1305E+02 | .5041E-01 | .3599E-01 |
| tetrachloroethene | .3492E+02 | .7106E+06 | .1325E+03 | .1883E+04 |
| trichloroethene | .2507E+00 | .1611E+03 | .2779E+00 | .2381E+01 |
| vinylacetate | .1470E-01 | .4788E+01 | .2295E-01 | .4096E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1044E+00 | .5542E+02 | .1627E-01 | .8191E+00 |

TOTAL MASS IN ALL PHASE = .6939E+04

TOTAL MASS IN GAS PHASE (kg) = .1146E+01
TOTAL MASS IN FREE PHASE (kg) = .6750E+04
TOTAL MASS IN WATER PHASE (kg) = .1686E+02
TOTAL MASS IN SOIL PHASE (kg) = .1716E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .8903E+01 | .5481E-04 | .7720E-03 | .8209E-01 |
| toluene | .3570E+06 | .6428E+00 | .9053E+01 | .3292E+04 |
| p-xylene | .1171E+07 | .6264E+00 | .8823E+01 | .1080E+05 |
| 111-trichloroethane | .2548E+06 | .2546E+00 | .3586E+01 | .2349E+04 |
| 1122-tetrachloroethane | .4438E+07 | .1905E+01 | .2683E+02 | .4091E+05 |
| 112-trichloroethane | .5045E+04 | .1184E-01 | .1668E+00 | .4651E+02 |
| 11-dichoroethane | .1276E+02 | .0000E+00 | .0000E+00 | .1177E+00 |
| 11-dichoroethene | .1019E+02 | .0000E+00 | .0000E+00 | .9397E-01 |
| methylenechloride | .1313E+02 | .0000E+00 | .0000E+00 | .1210E+00 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .7126E+06 | .1082E+00 | .1524E+01 | .6570E+04 |
| trichloroethene | .1640E+03 | .7765E-03 | .1094E-01 | .1512E+01 |
| vinylacetate | .4802E+01 | .0000E+00 | .0000E+00 | .4427E-01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .5637E+02 | .3233E-03 | .4554E-02 | .5198E+00 |

RESULTS AT TIME (DAYS) 919.227800

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .3964E+02 | .3349E+05 | .7693E+02 | .1346E+04 |
| p-xylene | .1920E+03 | .5472E+06 | .4191E+03 | .2114E+05 |
| 111-trichloroethane | .4284E+02 | .6481E+05 | .2991E+03 | .3374E+04 |
| 1122-tetrachloroethane | .6632E+03 | .2322E+07 | .1648E+05 | .1441E+06 |
| 112-trichloroethane | .3799E+00 | .2327E+03 | .3225E+01 | .3396E+02 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .5551E+02 | .5668E+06 | .2106E+03 | .2993E+04 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

TOTAL MASS IN ALL PHASE = .3726E+04

TOTAL MASS IN GAS PHASE (kg) = .9936E+00
TOTAL MASS IN FREE PHASE (kg) = .3534E+04
TOTAL MASS IN WATER PHASE (kg) = .1749E+02
TOTAL MASS IN SOIL PHASE (kg) = .1730E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k<br>g |
| benzene | .1585E+01 | .0000E+00 | .0000E+00 | .1461E-01 |
| toluene | .3496E+05 | .1229E+00 | .1731E+01 | .3223E+03 |
| p-xylene | .5689E+06 | .5953E+00 | .8384E+01 | .5245E+04 |
| 111-trichloroethane | .6851E+05 | .1328E+00 | .1870E+01 | .6317E+03 |
| 1122-tetrachloroethane | .2482E+07 | .2056E+01 | .2896E+02 | .2289E+05 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .2703E+03 | .1178E-02 | .1659E-01 | .2492E+01 |
| 11-dichoroethane | .2913E+01 | .0000E+00 | .0000E+00 | .2686E-01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .5700E+06 | .1720E+00 | .2423E+01 | .5256E+04 |
| trichloroethene | .2581E+01 | .0000E+00 | .0000E+00 | .2380E-01 |
| vinylacetate | .1564E+01 | .0000E+00 | .0000E+00 | .1442E-01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2269E+01 | .0000E+00 | .0000E+00 | .2092E-01 |

RESULTS AT TIME (DAYS) 1103.216000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .4032E+00 | .7102E+02 | .7826E+00 | .1369E+02 |
| p-xylene | .1138E+03 | .6758E+05 | .2483E+03 | .1252E+05 |
| 111-trichloroethane | .5566E+01 | .1755E+04 | .3886E+02 | .4384E+03 |
| 1122-tetrachloroethane | .5601E+03 | .4087E+06 | .1392E+05 | .1217E+06 |
| 112-trichloroethane | .9934E-02 | .1269E+01 | .8433E-01 | .8881E+00 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1371E+03 | .2917E+06 | .5201E+03 | .7390E+04 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .1514E-01 | .5156E+00 | .2363E-01 | .4218E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

TOTAL MASS IN ALL PHASE = .9275E+03

TOTAL MASS IN GAS PHASE (kg) = .8169E+00
TOTAL MASS IN FREE PHASE (kg) = .7698E+03
TOTAL MASS IN WATER PHASE (kg) = .1473E+02
TOTAL MASS IN SOIL PHASE (kg) = .1421E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .2475E+00 | .0000E+00 | .0000E+00 | .2282E-02 |

| | | | | |
|---|---|---|---|---|
| toluene | .8583E+02 | .1245E-02 | .1754E-01 | .7914E+00 |
| p-xylene | .8042E+05 | .3528E+00 | .4969E+01 | .7414E+03 |
| 111-trichloroethane | .2237E+04 | .1726E-01 | .2431E+00 | .2062E+02 |
| 1122-tetrachloroethane | .5445E+06 | .1737E+01 | .2447E+02 | .5020E+04 |
| 112-trichloroethane | .1594E+01 | .0000E+00 | .0000E+00 | .1470E-01 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2997E+06 | .4248E+00 | .5983E+01 | .2763E+04 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .5286E+00 | .0000E+00 | .0000E+00 | .4874E-02 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .4539E+00 | .0000E+00 | .0000E+00 | .4185E-02 |

no free oil after time (days) 1178.254000

RESULTS AT TIME (DAYS) 1209.181000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| p-xylene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 111-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 1122-tetrachloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 112-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

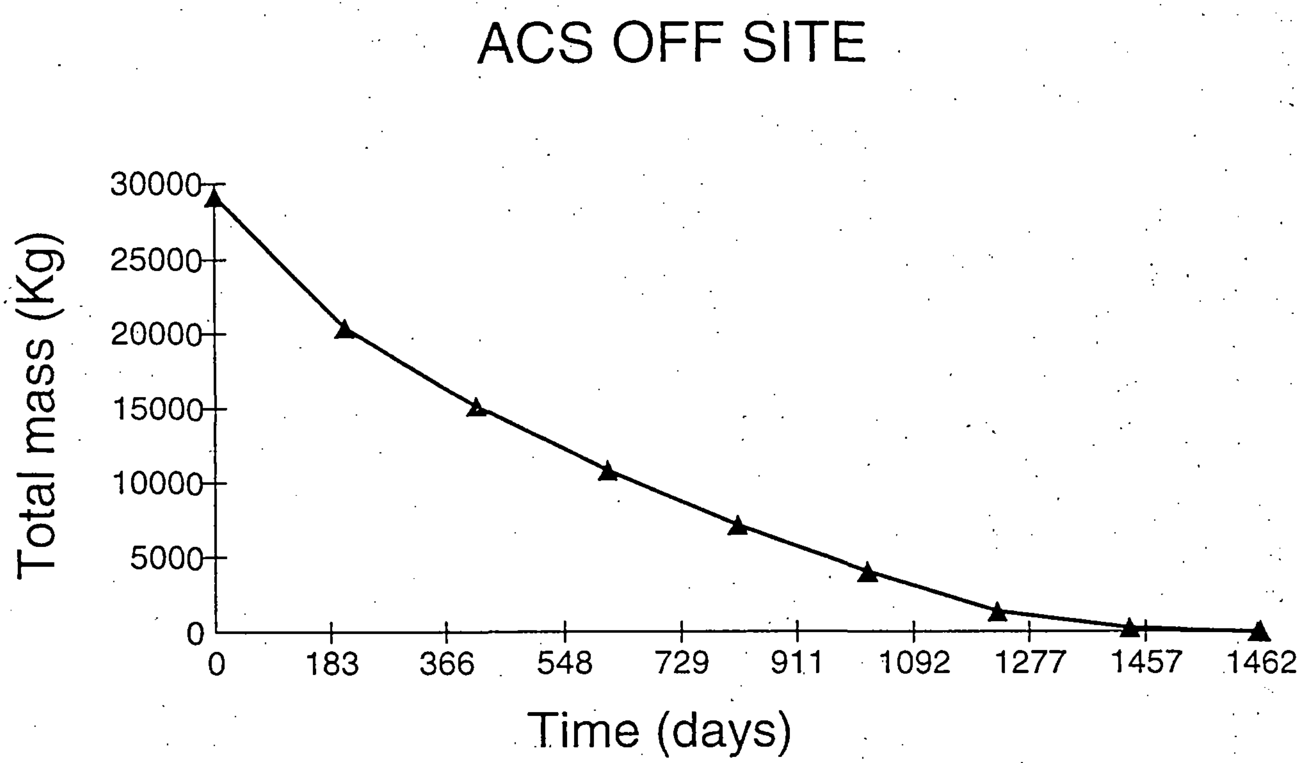
TOTAL MASS IN ALL PHASE = .0000E+00

TOTAL MASS IN GAS PHASE (kg) = .0000E+00
TOTAL MASS IN FREE PHASE (kg) = .0000E+00
TOTAL MASS IN WATER PHASE (kg) = .0000E+00
TOTAL MASS IN SOIL PHASE (kg) = .0000E+00

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|

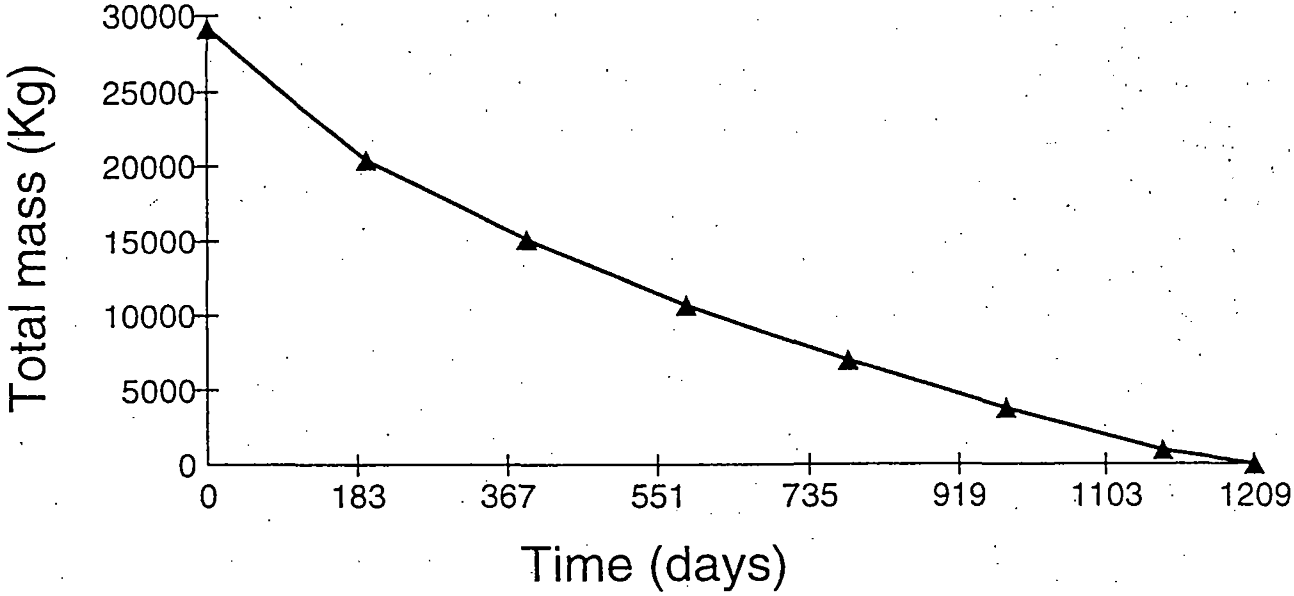
S

| | g | g/m3 | g/m3 | mg/k |
|---|---|---|---|---|
| g | | | | |
| benzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| toluene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| p-xylene | .0000E+00 | .5039E-03 | .7097E-02 | .0000E+00 |
| 111-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 1122-tetrachloroethane | .0000E+00 | .1201E+00 | .1692E+01 | .0000E+00 |
| 112-trichloroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .0000E+00 | .1853E-03 | .2610E-02 | .0000E+00 |
| trichloroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylacetate | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |



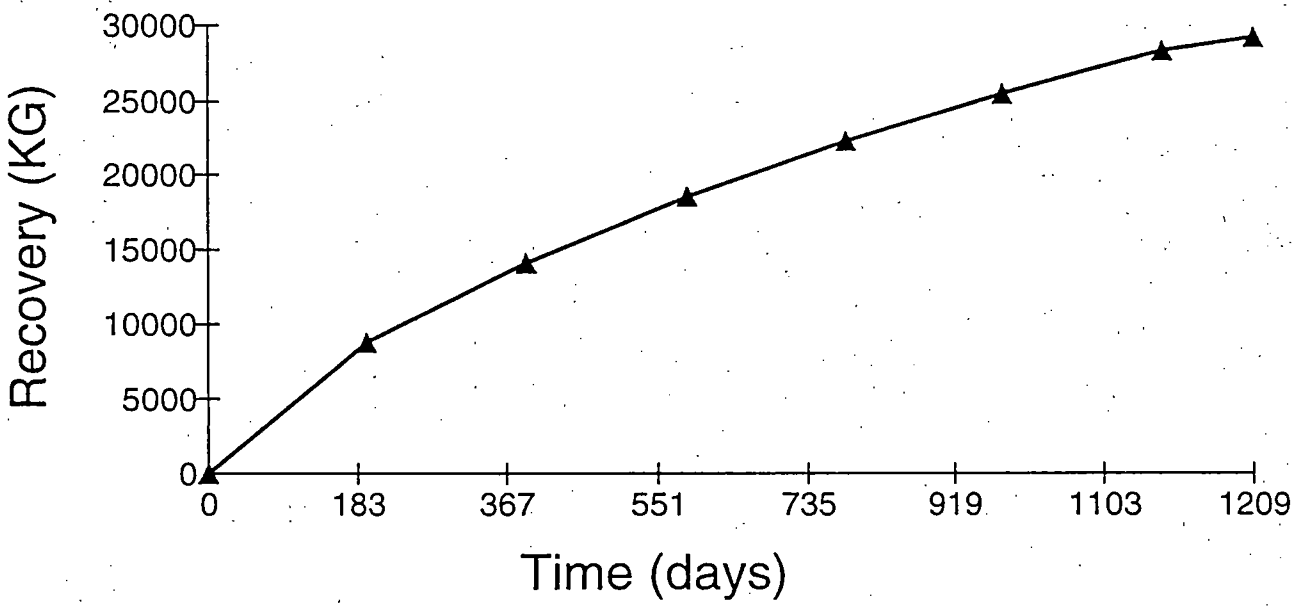
ACS OFF SITE
30000
25000
20000
15000
10000
5000
0
Total mass (Kg)
0
183
366
548
729
911
1092
1277
1457
1462
Time (days)

# ACS OFF SITE



Total mass (Kg)
30000
25000
20000
15000
10000
5000
0
0
183
367
551
735
919
1103
1209
Time (days)

# ACS OFF SITE



30000
25000
20000
15000
10000
5000
0
Recovery (KG)
0
183
367
551
735
919
1103
1209
Time (days)

## lowrate Estimation:

1) Choose Soil Type, or
   Optional - Enter your own permeability values (darcy)
2) Enter Well Radius (in)
3) Enter Radius of Influence (ft) & Interval Thickness*
4) Optional - Enter your own well vacuum (406" = max)
5) Click button to calculate Predicted Flowrate Ranges

S-hill bottoms

- ○ Medium Sand
- ○ Fine Sand
- ○ Silty Sand
- ○ Clayey Silts
- ◉ Input Your Own Permeability Range

**Permeability Range (darcy)**

1.75 to 10

**Well Radius** 2 in

**Radius of Influence** 30 ft

**Interval Thickness*** 5 ft

**-->Calculate Flowrate Ranges<--**

*thickness of screened interval, or permeable zone (whichever is smaller).

**Predicted Flowrate Ranges**

| Well Vacuum $P_w$ (in $H_2O$) | Flowrate (SCFM) (single well) 1.75 darcy | | 10 darcy |
|---|---|---|---|
| 5 | 0.46 | to | 2.65 |
| 10 | 0.92 | to | 5.27 |
| 20 | 1.82 | to | 10.41 |
| 40 | 3.55 | to | 20.29 |
| 60 | 5.19 | to | 29.65 |
| 120 | 9.55 | to | 54.59 |
| 108 | 8.75 | to | 49.98 |

4

About Soils (& Unit Conversions) 8 Info about Calculation

## owrate Estimation:

1) Choose Soil Type, or
   Optional - Enter your own permeability values (darcy)
2) Enter Well Radius (in)
3) Enter Radius of Influence (ft) & Interval Thickness*
4) Optional - Enter your own well vacuum (406" = max)
5) Click button to calculate Predicted Flowrate Ranges

- ○ Medium Sand
- ○ Fine Sand
- ○ Silty Sand
- ○ Clayey Silts
- ◉ Input Your Own Permeability Range

**Permeability Range (darcy)**

1.75 **to** 5.2

**Well Radius** 2 in

**Radius of Influence** 30 ft

**Interval Thickness*** 5 ft

**-->Calculate Flowrate Ranges<--**

*thickness of screened interval, or permeable zone (whichever is smaller).

### Predicted Flowrate Ranges

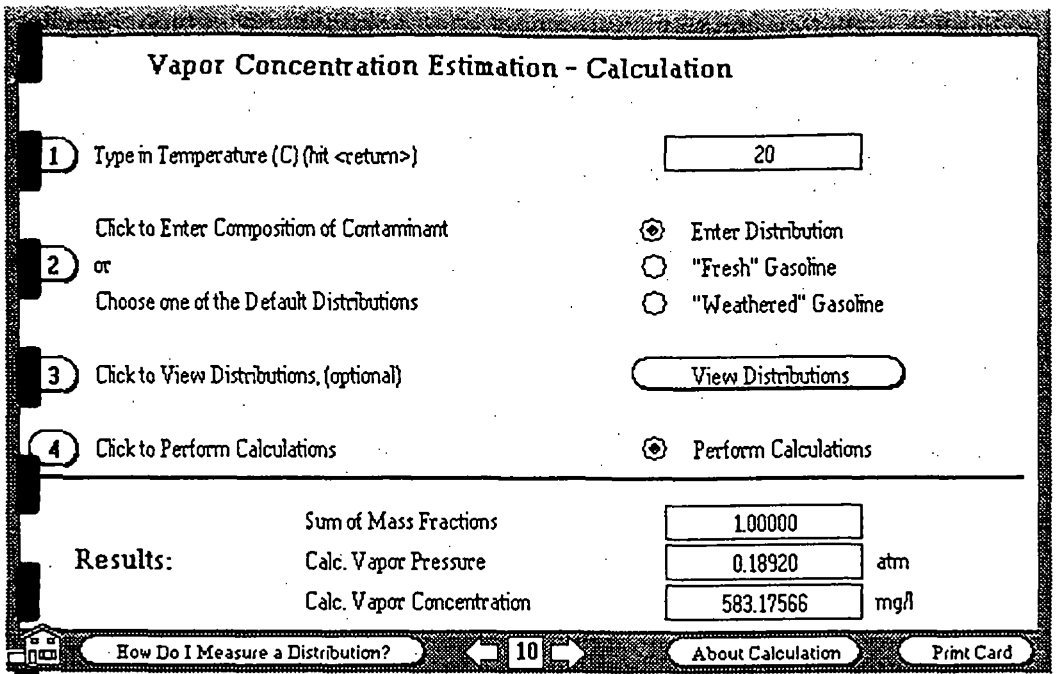
| Well Vacuum $P_w$ (in $H_2O$) | Flowrate (SCFM) (single well) 1.75 darcy | | 5.2 darcy |
|---|---|---|---|
| 5 | 0.46 | to | 1.38 |
| 10 | 0.92 | to | 2.74 |
| 20 | 1.82 | to | 5.41 |
| 40 | 3.55 | to | 10.55 |
| 60 | 5.19 | to | 15.42 |
| 120 | 9.55 | to | 28.38 |
| 108 | 8.75 | to | 25.99 |

4

About Soils (& Unit Conversions)

8

Info about Calculation


Vapor Concentration Estimation - Calculation
1
Type in Temperature (C) (hit <return>)
20
Click to Enter Composition of Contaminant
2
or
Choose one of the Default Distributions
Enter Distribution
"Fresh" Gasoline
"Weathered" Gasoline
3
Click to View Distributions. (optional)
View Distributions
4
Click to Perform Calculations
Perform Calculations
Results:
Sum of Mass Fractions
1.00000
Calc. Vapor Pressure
0.18920
atm
Calc. Vapor Concentration
583.17566
mg/l
How Do I Measure a Distribution?
10
About Calculation
Print Card

## *Maximum Removal Rate Estimates*

| | | | |
|---|---|---|---|
| Temperature (C) | 20 | | |
| Soil Type | User Defined | | |
| Soil Permeability Range (darcy) | 1.75 | to | 5.2 |
| Well Radius (in) | 2 | | |
| Radius of Influence (ft) | 30 | | |
| Contaminant Type | User Defined | | |
| Permeable Zone Thickness (ft) | 5 | | |

elect your unit preference below

◉ [lb/d]

○ [kg/d]

Note:

hese are "maximum removal rates", and should only be used as screening estimates to determine venting is even feasible at a iven site. Continue on to the next card to assess if these rates are cceptable...

| $P_w$ - Well Vacuum (in $H_2O$) | Flowrate Estimates [SCFM] (single well) | | | Max. Removal Rate Estimates [lb/d] (single well) | | |
|---|---|---|---|---|---|---|
| 5 | 0.46 | to | 1.38 | 24.45 | to | 73.35 |
| 10 | 0.92 | to | 2.74 | 49.52 | to | 147.47 |
| 20 | 1.82 | to | 5.41 | 100.49 | to | 298.71 |
| 40 | 3.55 | to | 10.55 | 206.70 | to | 614.27 |
| 60 | 5.19 | to | 15.42 | 319.61 | to | 949.61 |
| 120 | 9.55 | to | 28.38 | 711.15 | to | 2113.35 |
| 108 | 8.75 | to | 25.99 | 625.41 | to | 1857.65 |

12

Print Card

## *Is Soil Venting Appropriate?*

At this point, you compare the maximum possible removal rate with your desired removal rate.

If the maximum removal rate does not exceed your desired removal rate, then soil venting is not likely to meet your needs, and you should consider another treatment technology, or make your needs more realistic.

In the next cards, we will refine the removal rate estimates, in order to decide if venting can achieve your objectives.

(1) Enter Estimated Spill Mass 3624000 ○ kg ◉ lb

(2) Enter Desired Remediation Time 3650 days

(3) -->Press to get Rates<--

**Single Vertical Well Results**

| | | |
|---|---|---|
| Desired Removal Rate: | 992.876 | [lb/d] |
| Gauge Vacuum (in H2O): | 120 | [in H2O] |
| Min Flowrate @ 120in H2O | 9.55 | [SCFM] |
| Max Flowrate @ 120in H2O | 28.38 | [SCFM] |
| Max. Est. Removal Rate: | | |
| (lower estimate) - per well | 711.15 | [lb/d] |
| (upper estimate) - per well | 2113.35 | [lb/d] |

-> Import Data <-

FIRST PRESS THE IMPORT DATA BUTTON!

These are the results for the contaminant type that you have specified. All of this

**Saturated Vapor Concentration at time=0** .4096E+03 [mg/L]

**Min Volume to Remove >90% of Initial Residual** 12.95 [L-air/g-residual]

Temperature (œC): 20

Contaminant Type: User Defined

| Qt/M(0) L-air/ g-residual | Vapor Conc. [% Initial] | Residual Level [% Initial] | BP #1 Residual [% total] | BP #2 Residual [% total] | BP #3 Residual [% total] | BP #4 Residual [% total] | BP #5 Residual [% total] |
|---|---|---|---|---|---|---|---|
| 10.77 | 11.25 | 18.10 | .00 | .00 | .05 | 5.22 | 94.73 |
| 11.86 | 11.16 | 13.10 | .00 | .00 | .00 | 4.24 | 95.76 |
| 12.95 | 11.17 | 8.10 | .00 | .00 | .00 | 3.25 | 96.75 |
| 14.05 | 11.21 | 3.10 | .00 | .00 | .00 | 1.27 | 98.73 |
| 14.08 | 11.21 | 2.94 | .00 | .00 | .00 | 1.25 | 98.75 |
| 14.11 | 11.21 | 2.80 | .00 | .00 | .00 | 1.22 | 98.78 |
| 14.14 | 11.22 | 2.66 | .00 | .00 | .00 | 1.19 | 98.81 |
| 14.17 | 11.22 | 2.52 | .00 | .00 | .00 | 1.17 | 98.83 |



Print Card

# Is Venting Appropriate?

This is a complete summary of the data and results. Based upon these numbers, a "minimum number of wells" has been calculated, which should give you some indication of how appropriate venting is for your application. Note that this is the number of wells if circumstances are ideal, which they rarely are.

The next card discusses some of the conditions that may limit the effectiveness

| | |
|---|---|
| Temperature [oeC]: | 20 |
| Contaminant Type: | User Defined |
| Soil Type: | User Defined |
| Well Radius [in]: | 2 |
| Est. Radius of Influence [ft]: | 30 |
| Permeable Zone Thickness [ft]: | 5 |
| Flowrate per Well (120" Vac) [SCFM] | 9.55 |
| Flowrate per Well (120" Vac) [SCFM] | 28.38 |
| Min. Vol. of Air [L/g-residual]: | 12.95 |
| Estimated Spill Mass: | 3624000 lb |
| Desired Remediation Time [days]: | 3650 |

3.54 < **Minimum # of Wells Based on Your Input Parameters** < 10.52

## Help: Boundary Layer Equations - Calculation

① **Soil Type (choose one)**

- ○ Medium Sand ○ Clayey Silts
- ○ Silty Sand ○ Fine Sand
- ◉ Input Your Own Permeability Range

1.75 **to** 5.2 **[darcys]**

② **Process Variables:**

| | |
|---|---|
| 5 | thickness of screened interval [ft] |
| 30 | radius of influence of venting well [ft] |
| 2 | venting well radius [in] |
| 60 | applied vacuum at well [in H2O] |
| 225 | radial width of contaminated zone |

③ --> Calculate <--

greatest removal rates, in this case, correspond to the lowest efficiency values. This is because the driving force for removal is a concentration gradient in the vapor phase.

The most cost-efficient systems, therefore, balance removal rates -vs- the cost of removing and treating large volumes of dilute vapors. The screened interval should, in this case, be chosen to produce a relative efficiency of about 20%.

**Relative Efficiency = (%)** 100 **to** 100

Return

## Help: Low Permeability Lenses - Calculation

**1 Process Variables:**

(input values)

| | |
|---|---|
| 4 | venting well radius [m] |
| 225 | radial width of contaminated zone [ft] |
| 19198 | residual contaminant level [mg/kg] |

**2 Contaminant Properties:**

| | |
|---|---|
| 74.146223 | contaminant molecular weight [g/mole] |
| 143.792 | contaminant vapor pressure [mm Hg] |
| 20 | *temperature (C)* |

○ use values already input from Card 10

Just enter values into the appropriate fields, then click on the "Calculate" button.

3 --> Calculate <--

| Time (days) | Removal Rate (kg/d) | δ (m) |
|---|---|---|
| 1 | 17204.480 | 0.076 |
| 7 | 6502.682 | 0.201 |
| 30 | 3141.094 | 0.415 |
| 60 | 2221.089 | 0.588 |
| 120 | 1570.547 | 0.831 |
| 180 | 1282.346 | 1.018 |
| 240 | 1110.544 | 1.175 |
| 360 | 906.756 | 1.439 |
| 540 | 740.363 | 1.763 |
| 720 | 641.173 | 2.035 |
| 1080 | 523.516 | 2.493 |

Return

H30

# Design Input Parameters...

(soil stratigraphy & contaminant characteristics)

Select the total mass units that you prefer ○ [kg] ◉ [lb]

Please enter the required information for each distinct soil layer, Please enter the required information for each distinct soil layer, click on the "Update" button, and then proceed to the next card (i.e. click on right arrow at bottom).

Clear All Entries

| | Description of Soil Unit | Depth BGS* [ft] | | | Description of Contamination | Contaminant Distribution radius [ft] | interval thickness [ft] | average conc. [mg/kg] | Calc. Total Mass [lb] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | fill | 0 | to | 3 | Mixture | 225 | 3 | 120410 | 6102026.7 |
| 2 | sand | 3 | to | 5 | Mixture | 225 | 2 | 6425 | 217066.8 |
| 3 | sand | 5 | to | 10 | Mixture | 225 | 5 | 30758 | 2597875.8 |
| 4 | sand | 0 | to | 0 | Mixture | 225 | 0 | 5592 | 0.0 |
| 5 | | | to | | | | | | 0.0 |
| 6 | | | to | | | | | | 0.0 |
| 7 | | | to | | | | | | 0.0 |
| 8 | | | to | | | | | | 0.0 |

* Below Ground Surface

Update

Return

SD2

# Design Input Parameters...

Please enter the required information for each distinct soil layer, and then proceed to the next card.

Note: - click on any table heading to get more info
- use arrow key to move between cells

- Medium Sand
- Fine Sand
- Silty Sand
- Clayey Silts

| | Description of Soil Unit | Permeability* [darcy] | | | Design Vacuum [in H2O] | Extraction Well Construction well radius [in] | screen thickness [ft] | radius of influence [ft] | Critical Volume of Air** [L/g] | Efficiency [%] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | fill | 1.75 | to | 5.2 | 60 | 4 | 0 | 30 | 12.95 | 100 |
| 2 | sand | 1.75 | to | 5.2 | 60 | 4 | 2 | 30 | 12.95 | 100 |
| 3 | sand | 1.75 | to | 5.2 | 60 | 4 | 5 | 30 | 12.95 | 100 |
| 4 | sand | 0 | to | 0 | 60 | 4 | 0 | 30 | 12..95 | 100 |
| 5 | | | to | | | | | | | |
| 6 | | | to | | | | | | | |
| 7 | | | to | | | | | | | |
| 8 | | | to | | | | | | | |

* Enter or choose from list at top right

** minimum volume of vapor required to achieve remediation

Clear All Entries | Return | SD3

## Design Input Parameters...

Please enter (1) the desired time period for remediation, (2) the design gauge vacuum, and then (3) click the "update" button.

Note: - click on any table heading to get more info
- use arrow key to move between cells

(3) Update

| | Description of Soil Unit | (1) Time for Clean-up [days] | (2) Design Vacuum (in H2O) | Flowrate per Vapor Extraction Well [SCFM] | | | Minimum Number of Wells Based on Area | Based on Critical Volume** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | fill | 3650 | 60 | NA | to | NA | 56.3 | NA | to | NA |
| 2 | sand | 3650 | 60 | 2.39 | to | 7.11 | 56.3 | 0.7 | to | 2.0 |
| 3 | sand | 3650 | 60 | 5.99 | to | 17.79 | 56.3 | 4.1 | to | 12.3 |
| 4 | sand | 0 | 60 | NA | to | NA | 56.3 | NA | to | NA |
| 5 | | | | NA | to | NA | NA | NA | to | NA |
| 6 | | | | NA | to | NA | NA | NA | to | NA |
| 7 | | | | NA | to | NA | NA | NA | to | NA |
| 8 | | | | NA | to | NA | NA | NA | to | NA |

NA - not enough input data

** minimum volume of vapor required to achieve remediation

Clear All Entries | Return | SD4

## *Is Soil Venting Appropriate?*

At this point, you compare the maximum possible removal rate with your desired removal rate.

If the maximum removal rate does not exceed your desired removal rate, then soil venting is not likely to meet your needs, and you should consider another treatment technology, or make your needs more realistic.

In the next cards, we will refine the removal rate estimates, in order to decide if venting can achieve your objectives.

(1) Enter Estimated Spill Mass 3624000 ○ kg ◉ lb

(2) Enter Desired Remediation Time 5475 days

(3) -->Press to get Rates<--

**Single Vertical Well Results**

| | | |
|---|---|---|
| Desired Removal Rate: | 661.917 | [lb/d] |
| Gauge Vacuum (in H2O): | 120 | [in H2O] |
| Min Flowrate @ 120in H2O | 9.55 | [SCFM] |
| Max Flowrate @ 120in H2O | 28.38 | [SCFM] |
| Max. Est. Removal Rate: | | |
| (lower estimate) - per well | 711.15 | [lb/d] |
| (upper estimate) - per well | 2113.35 | [lb/d] |

# Is Venting Appropriate?

This is a complete summary of the data and results. Based upon these numbers, a "minimum number of wells" has been calculated, which should give you some indication of how appropriate venting is for your application. Note that this is the number of wells if circumstances are ideal, which they rarely are.

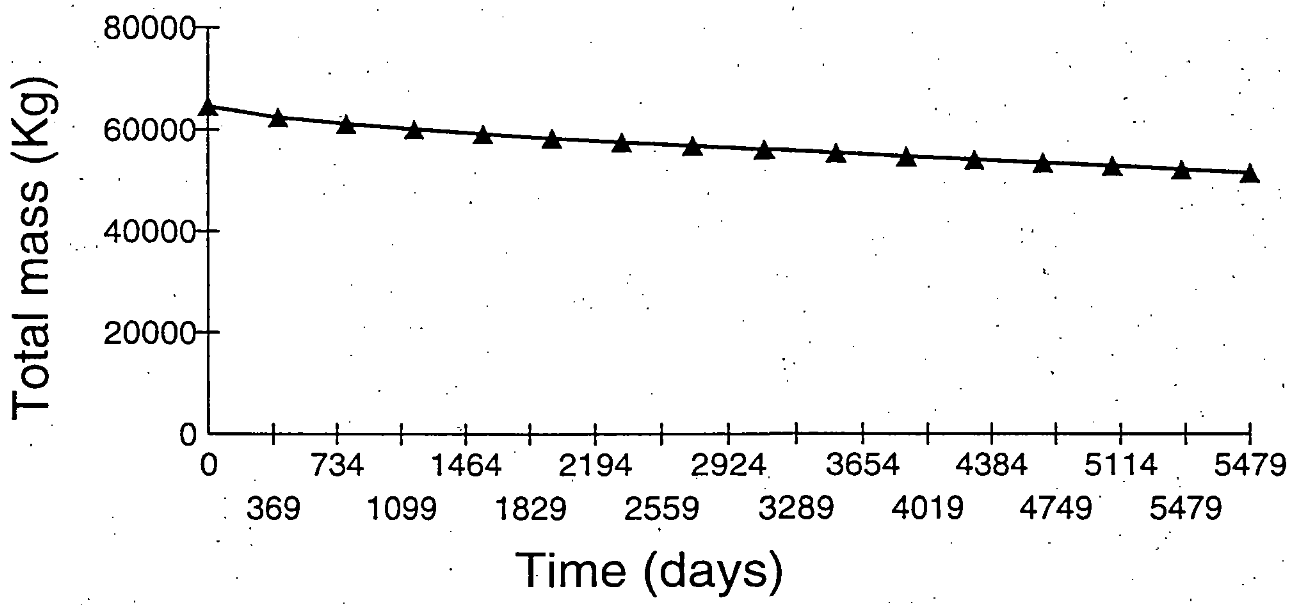
The next card discusses some of the conditions that may limit the effectiveness

| | |
|---|---|
| Temperature [oeC]: | 20 |
| Contaminant Type: | User Defined |
| Soil Type: | User Defined |
| Well Radius [in]: | 2 |
| Est. Radius of Influence [ft]: | 30 |
| Permeable Zone Thickness [ft]: | 5 |
| Flowrate per Well (120" Vac) [SCFM] | 9.55 |
| Flowrate per Well (120" Vac) [SCFM] | 28.38 |
| Min. Vol. of Air [L/g-residual]: | 12.95 |
| Estimated Spill Mass: | 3624000 lb |
| Desired Remediation Time [days]: | 5475 |

2.36 < **Minimum # of Wells Based on Your Input Parameters** < 7.01

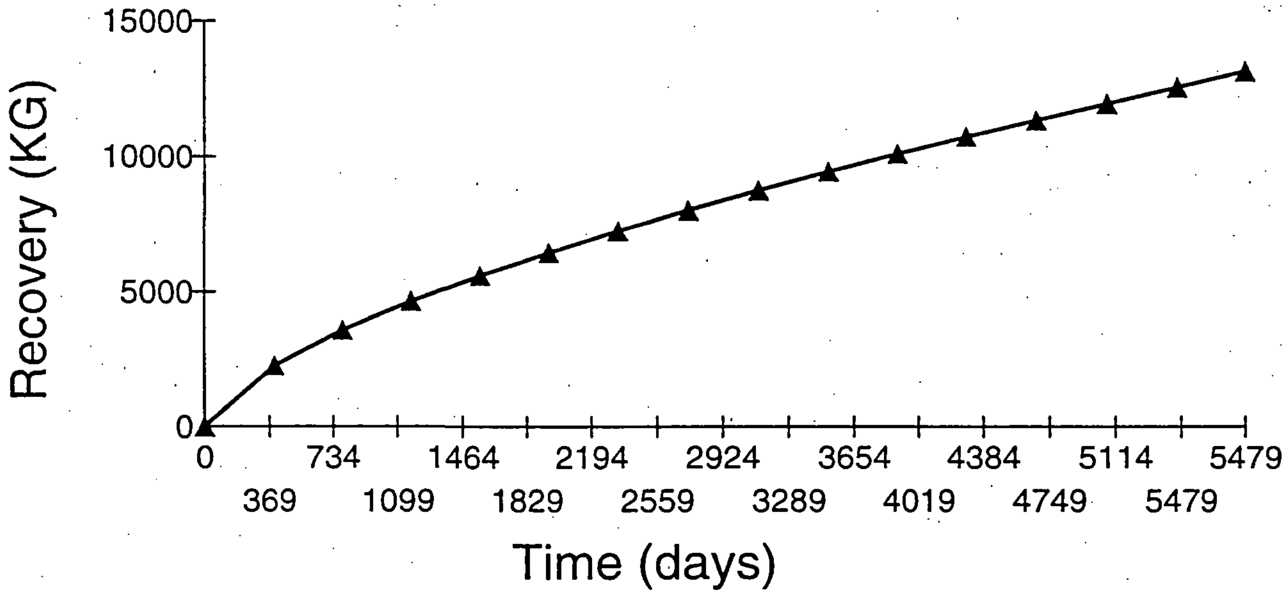
18

# ACS Still Bottoms




1.75darcy

# ACS Still Bottoms



```
[HEADER]
FILETYPE=
PROJECT_TITLE=ACS Still Bottoms
PROJECT_FILE=C:\DAEM\BIOSVE\STLBOT.SPF
PROJECT_SPECIES_FILE=C:\DAEM\BIOSVE\STLBOT.SSF
NUMERICAL_MODEL=BIOSVE.PIF
MODEL_INPUT_FILE=C:\DAEM\BIOSVE\STLBOT.DAT
MODEL_OUTPUT_FILE=C:\DAEM\BIOSVE\STLBOT.OUT
MODEL_SPECIES_FILE=C:\DAEM\BIOSVE\STLBOT.SPC
MODEL_ERROR_FILE=C:\DAEM\BIOSVE\STLBOT.ERR
PREPROCESSOR_VERSION=
NUMERICAL_MODEL_VERSION=

[CONTROL_PARAMETERS]
NTSP=14
IFOUR=1
HSMT=64714
Q=5.19
DELT=0.5
DTMX=5
TFACT=1.02
TMAX=5475
TPNT=365
TEMP=20
ETA=0.071
SOILV=80.5
WC=0.15
RHOB=1.7
FOC=0.005
HIN=1.5
HEX=0.02
EBIO=0.02
HRES=6471
```

```
[SPECIES_DATA]
SNAME1=benzene
PMF1=0.012
PMW1=78.1
PVP1=0.1
PBP1=80
PSI1=1780
PKOW1=135
SNAME2=toluene
PMF2=0.299
PMW2=92.1
PVP2=0.029
PBP2=111
PSI2=515
PKOW2=490
SNAME3=p-xylene
PMF3=0.107
PMW3=106.2
PVP3=0.0086
PBP3=138
PSI3=198
PKOW3=1413
SNAME4=111-trichloroethane
PMF4=0.053
PMW4=133.5
PVP4=0.0162
PBP4=74.1
PSI4=1500
PKOW4=316
SNAME5=1122-tetrachloroethane
PMF5=0.338
PMW5=167.83
PVP5=0.007
PBP5=146.2
PSI5=2900
PKOW5=245
SNAME6=112-trichloroethane
PMF6=0.012
PMW6=133.4
PVP6=0.04
PBP6=113.8
PSI6=4500
PKOW6=295
SNAME7=11-dichoroethane
PMF7=0.012
PMW7=182
PVP7=0.24
PBP7=57.5
PSI7=5500
PKOW7=61.7
SNAME8=11-dichoroethene
```

PMF8=0.012
PMW8=96.94
PVP8=0.79
PBP8=37
PSI8=2250
PKOW8=69.2
SNAME9=methylenechloride
PMF9=0.024
PMW9=106.7
PVP9=0.476
PBP9=93.7
PSI9=2000
PKOW9=20
SNAME10=tetrachloroethene
PMF10=0.033
PMW10=165.8
PVP10=0.0024
PBP10=121
PSI10=150
PKOW10=398
SNAME11=trichloroethene
PMF11=0.02
PMW11=131.4
PVP11=0.076
PBP11=87.2
PSI11=1100
PKOW11=240
SNAME12=vinylacetate
PMF12=0.021
PMW12=86
PVP12=0.15
PBP12=72
PSI12=2000
PKOW12=0.5
SNAME13=vinylchloride
PMF13=0.021
PMW13=62.5
PVP13=3.5
PBP13=13.4
PSI13=2670
PKOW13=24
SNAME14=Ethylbenzene
PMF14=0.036
PMW14=106.7
PVP14=0.092
PBP14=136.2
PSI14=152
PKOW14=1410

```
'benzene'                                   0.0120    78.1000   0.1000
80.0000   1780.0000 135.0000
'toluene'                                   0.2990    92.1000   0.0290
111.0000  515.0000  490.0000
'p-xylene'                                  0.1070    106.2000  0.0086
138.0000  198.0000  1413.0000
'111-trichloroethane'                       0.0530    133.5000  0.0162
74.1000   1500.0000 316.0000
'1122-tetrachloroethane'                    0.3380    167.8300  0.0070
146.2000  2900.0000 245.0000
'112-trichloroethane'                       0.0120    133.4000  0.0400
113.8000  4500.0000 295.0000
'11-dichoroethane'                          0.0120    182.0000  0.2400
57.5000   5500.0000 61.7000
'11-dichoroethene'                          0.0120    96.9400   0.7900
37.0000   2250.0000 69.2000
'methylenechloride'                         0.0240    106.7000  0.4760
93.7000   2000.0000 20.0000
'tetrachloroethene'                         0.0330    165.8000  0.0024
121.0000  150.0000  398.0000
'trichloroethene'                           0.0200    131.4000  0.0760
87.2000   1100.0000 240.0000
'vinylacetate'                              0.0210    86.0000   0.1500
72.0000   2000.0000 0.5000
'vinylchloride'                             0.0210    62.5000   3.5000
13.4000   2670.0000 24.0000
'Ethylbenzene'                              0.0360    106.7000  0.0920
136.2000  152.0000  1410.0000
```

```
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
+                                                               +
+               BioSVE For Window                               +
+                                                               +
+   SOIL VACUUM EXTRACTION CHEMICAL EQUILIBRIUM MODEL           +
+     BASED ON JOHNSON ET AL. (1990) GROUND WATER               +
+                                                               +
+                                                               +
+                                                               +
+                                                               +
+                  COPYRIGHT 1995                               +
+                 ASHOK KATYAL, Ph.D.                           +
+          DRAPER ADEN ENVIRONMENTAL MODELING                   +
+            BLACKSBURG, VA 24060, U.S.A.                       +
+                                                               +
+                                                               +
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
```

TITLE: ACS Still Bottoms

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```
air flow rate   (liters/day)          = .2115E+06
total mass of contaminant (g)         = .6471E+08
maximum simulation time (days)        = .5475E+04
starting time step (days)             = .5000E+00
maximum time step  (days)             = .5000E+01
time increment factor                 =.10200E+01
printout time interval (days)         =.36500E+03
volumetric water content(fraction)    =.15000E+00
bulk density (g/cm^3)                 =.17000E+01
foc                                   =.50000E-02
contaminated soil vol. (m^3)          =.80500E+02
temperature (C)                       =.20000E+02
intercept in free prod.recov.eqn.     =.15000E+01
exponent in free prod. recov. eqn.    =.20000E-01
bio efficiency (fraction)             =.20000E-01
residual oil mass (kg)                =.64710E+04
venting efficiency (fraction)         = .7100E-01
```

5.1 cfm

| SPECIES | VAP PRES atm | BOILING POINT deg C | SOL LIMIT ppm | KOW g/g |
|---|---|---|---|---|
| benzene | .1000E+00 | .8000E+02 | .1780E+04 | .1350E+03 |
| toluene | .2900E-01 | .1110E+03 | .5150E+03 | .4900E+03 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .8600E-02 | .1380E+03 | .1980E+03 | .1413E+04 |
| 111-trichloroethane | .1620E-01 | .7410E+02 | .1500E+04 | .3160E+03 |
| 1122-tetrachloroethane | .7000E-02 | .1462E+03 | .2900E+04 | .2450E+03 |
| 112-trichloroethane | .4000E-01 | .1138E+03 | .4500E+04 | .2950E+03 |
| 11-dichoroethane | .2400E+00 | .5750E+02 | .5500E+04 | .6170E+02 |
| 11-dichoroethene | .7900E+00 | .3700E+02 | .2250E+04 | .6920E+02 |
| methylenechloride | .4760E+00 | .9370E+02 | .2000E+04 | .2000E+02 |
| tetrachloroethene | .2400E-02 | .1210E+03 | .1500E+03 | .3980E+03 |
| trichloroethene | .7600E-01 | .8720E+02 | .1100E+04 | .2400E+03 |
| vinylacetate | .1500E+00 | .7200E+02 | .2000E+04 | .5000E+00 |
| vinylchloride | .3500E+01 | .1340E+02 | .2670E+04 | .2400E+02 |
| Ethylbenzene | .9200E-01 | .1362E+03 | .1520E+03 | .1410E+04 |
| MASS FRACTION SUM | 1.000000 | | | |

| SPECIES | MOL WEIGHT g/mol | HENRY COEFF DIMENSIONLESS |
|---|---|---|
| benzene | .7810E+02 | .0000E+00 |
| toluene | .9210E+02 | .0000E+00 |
| p-xylene | .1062E+03 | .0000E+00 |
| 111-trichloroethane | .1335E+03 | .0000E+00 |
| 1122-tetrachloroethane | .1678E+03 | .0000E+00 |
| 112-trichloroethane | .1334E+03 | .0000E+00 |
| 11-dichoroethane | .1820E+03 | .0000E+00 |
| 11-dichoroethene | .9694E+02 | .0000E+00 |
| methylenechloride | .1067E+03 | .0000E+00 |
| tetrachloroethene | .1658E+03 | .0000E+00 |
| trichloroethene | .1314E+03 | .0000E+00 |
| vinylacetate | .8600E+02 | .0000E+00 |
| vinylchloride | .6250E+02 | .0000E+00 |
| Ethylbenzene | .1067E+03 | .0000E+00 |

sgmlti 556024.500000

RESULTS AT TIME (DAYS) 0.000000E+00

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1673E+03 | .7742E+06 | .3838E+03 | .1850E+04 |
| toluene | .1210E+04 | .1930E+08 | .2348E+04 | .4107E+05 |
| p-xylene | .1284E+03 | .6910E+07 | .2802E+03 | .1414E+05 |
| 111-trichloroethane | .1197E+03 | .3419E+07 | .8357E+03 | .9428E+04 |
| 1122-tetrachloroethane | .3296E+03 | .2179E+08 | .8191E+04 | .7164E+05 |
| 112-trichloroethane | .6655E+02 | .7700E+06 | .5650E+03 | .5950E+04 |
| 11-dichoroethane | .4017E+03 | .7745E+06 | .5091E+03 | .1121E+04 |

| | | | | |
|---|---|---|---|---|
| 11-dichoroethene | .1321E+04 | .7739E+06 | .3907E+03 | .9652E+03 |
| methylenechloride | .1595E+04 | .1550E+07 | .6322E+03 | .4514E+03 |
| tetrachloroethene | .1107E+02 | .2135E+07 | .4201E+02 | .5969E+03 |
| trichloroethene | .2122E+03 | .1292E+07 | .2352E+03 | .2015E+04 |
| vinylacetate | .4401E+03 | .1358E+07 | .6869E+03 | .1226E+02 |
| vinylchloride | .1014E+05 | .1341E+07 | .4360E+04 | .3736E+04 |
| Ethylbenzene | .4623E+03 | .2326E+07 | .7206E+02 | .3627E+04 |

TOTAL MASS IN ALL PHASE = .6471E+05

TOTAL MASS IN GAS PHASE (kg) = .1660E+02
TOTAL MASS IN FREE PHASE (kg) = .6452E+05
TOTAL MASS IN WATER PHASE (kg) = .1953E+02
TOTAL MASS IN SOIL PHASE (kg) = .1566E+03

| SPECIES<br>S | MASS<br>g | CONC<br>WELL GAS<br>g/m3 | CONC<br>SOIL GAS<br>g/m3 | CONC<br>SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| toluene | .1935E+08 | .0000E+00 | .0000E+00 | .1414E+06 |
| p-xylene | .6924E+07 | .0000E+00 | .0000E+00 | .5060E+05 |
| 111-trichloroethane | .3430E+07 | .0000E+00 | .0000E+00 | .2506E+05 |
| 1122-tetrachloroethane | .2187E+08 | .0000E+00 | .0000E+00 | .1598E+06 |
| 112-trichloroethane | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| 11-dichoroethane | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| 11-dichoroethene | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| methylenechloride | .1553E+07 | .0000E+00 | .0000E+00 | .1135E+05 |
| tetrachloroethene | .2136E+07 | .0000E+00 | .0000E+00 | .1561E+05 |
| trichloroethene | .1294E+07 | .0000E+00 | .0000E+00 | .9458E+04 |
| vinylacetate | .1359E+07 | .0000E+00 | .0000E+00 | .9931E+04 |
| vinylchloride | .1359E+07 | .0000E+00 | .0000E+00 | .9931E+04 |
| Ethylbenzene | .2330E+07 | .0000E+00 | .0000E+00 | .1702E+05 |

end of initial conditions

RESULTS AT TIME (DAYS) 368.606000

| SPECIES | ........MASS (g) IN PHASES ....<br>GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1689E+03 | .7416E+06 | .3876E+03 | .1868E+04 |
| toluene | .1259E+04 | .1906E+08 | .2444E+04 | .4275E+05 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .1348E+03 | .6883E+07 | .2942E+03 | .1484E+05 |
| 111-trichloroethane | .1253E+03 | .3395E+07 | .8746E+03 | .9866E+04 |
| 1122-tetrachloroethane | .3463E+03 | .2172E+08 | .8605E+04 | .7527E+05 |
| 112-trichloroethane | .6893E+02 | .7566E+06 | .5852E+03 | .6163E+04 |
| 11-dichoroethane | .3821E+03 | .6990E+06 | .4843E+03 | .1067E+04 |
| 11-dichoroethene | .9940E+03 | .5524E+06 | .2940E+03 | .7263E+03 |
| methylenechloride | .1372E+04 | .1265E+07 | .5437E+03 | .3882E+03 |
| tetrachloroethene | .1166E+02 | .2132E+07 | .4423E+02 | .6285E+03 |
| trichloroethene | .2164E+03 | .1250E+07 | .2400E+03 | .2056E+04 |
| vinylacetate | .4351E+03 | .1273E+07 | .6790E+03 | .1212E+02 |
| vinylchloride | .2419E+04 | .3034E+06 | .1040E+04 | .8912E+03 |
| Ethylbenzene | .4685E+03 | .2236E+07 | .7302E+02 | .3675E+04 |

TOTAL MASS IN ALL PHASE = .6246E+05

TOTAL MASS IN GAS PHASE (kg) = .8402E+01
TOTAL MASS IN FREE PHASE (kg) = .6227E+05
TOTAL MASS IN WATER PHASE (kg) = .1659E+02
TOTAL MASS IN SOIL PHASE (kg) = .1602E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .7441E+06 | .4156E+00 | .5854E+01 | .5437E+04 |
| toluene | .1911E+08 | .3097E+01 | .4362E+02 | .1396E+06 |
| p-xylene | .6898E+07 | .3319E+00 | .4674E+01 | .5041E+05 |
| 111-trichloroethane | .3406E+07 | .3082E+00 | .4341E+01 | .2489E+05 |
| 1122-tetrachloroethane | .2180E+08 | .8518E+00 | .1200E+02 | .1593E+06 |
| 112-trichloroethane | .7634E+06 | .1696E+00 | .2388E+01 | .5578E+04 |
| 11-dichoroethane | .7010E+06 | .9411E+00 | .1325E+02 | .5122E+04 |
| 11-dichoroethene | .5544E+06 | .2456E+01 | .3459E+02 | .4051E+04 |
| methylenechloride | .1267E+07 | .3383E+01 | .4764E+02 | .9261E+04 |
| tetrachloroethene | .2133E+07 | .2863E-01 | .4033E+00 | .1559E+05 |
| trichloroethene | .1253E+07 | .5324E+00 | .7499E+01 | .9155E+04 |
| vinylacetate | .1275E+07 | .1071E+01 | .1508E+02 | .9313E+04 |
| vinylchloride | .3078E+06 | .6072E+01 | .8552E+02 | .2250E+04 |
| Ethylbenzene | .2240E+07 | .1152E+01 | .1623E+02 | .1637E+05 |

RESULTS AT TIME (DAYS) 733.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |

| | | | | |
|---|---|---|---|---|
| benzene | .1662E+03 | .7097E+06 | .3813E+03 | .1838E+04 |
| toluene | .1278E+04 | .1882E+08 | .2481E+04 | .4339E+05 |
| p-xylene | .1381E+03 | .6855E+07 | .3013E+03 | .1520E+05 |
| 111-trichloroethane | .1279E+03 | .3370E+07 | .8927E+03 | .1007E+05 |
| 1122-tetrachloroethane | .3549E+03 | .2165E+08 | .8819E+04 | .7713E+05 |
| 112-trichloroethane | .6962E+02 | .7432E+06 | .5910E+03 | .6225E+04 |
| 11-dichoroethane | .3536E+03 | .6291E+06 | .4482E+03 | .9872E+03 |
| 11-dichoroethene | .7226E+03 | .3906E+06 | .2137E+03 | .5280E+03 |
| methylenechloride | .1144E+04 | .1026E+07 | .4535E+03 | .3238E+03 |
| tetrachloroethene | .1197E+02 | .2130E+07 | .4542E+02 | .6454E+03 |
| trichloroethene | .2152E+03 | .1209E+07 | .2386E+03 | .2044E+04 |
| vinylacetate | .4187E+03 | .1192E+07 | .6535E+03 | .1167E+02 |
| vinylchloride | .5382E+03 | .6566E+05 | .2314E+03 | .1983E+03 |
| Ethylbenzene | .4625E+03 | .2147E+07 | .7209E+02 | .3629E+04 |

TOTAL MASS IN ALL PHASE = .6112E+05

TOTAL MASS IN GAS PHASE (kg) = .6002E+01
TOTAL MASS IN FREE PHASE (kg) = .6093E+05
TOTAL MASS IN WATER PHASE (kg) = .1582E+02
TOTAL MASS IN SOIL PHASE (kg) = .1622E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .7121E+06 | .4090E+00 | .5761E+01 | .5203E+04 |
| toluene | .1886E+08 | .3143E+01 | .4427E+02 | .1378E+06 |
| p-xylene | .6871E+07 | .3397E+00 | .4785E+01 | .5021E+05 |
| 111-trichloroethane | .3381E+07 | .3144E+00 | .4428E+01 | .2471E+05 |
| 1122-tetrachloroethane | .2173E+08 | .8729E+00 | .1229E+02 | .1588E+06 |
| 112-trichloroethane | .7501E+06 | .1713E+00 | .2413E+01 | .5481E+04 |
| 11-dichoroethane | .6309E+06 | .8709E+00 | .1227E+02 | .4610E+04 |
| 11-dichoroethene | .3921E+06 | .1786E+01 | .2515E+02 | .2865E+04 |
| methylenechloride | .1028E+07 | .2822E+01 | .3975E+02 | .7514E+04 |
| tetrachloroethene | .2130E+07 | .2940E-01 | .4140E+00 | .1557E+05 |
| trichloroethene | .1212E+07 | .5295E+00 | .7458E+01 | .8853E+04 |
| vinylacetate | .1193E+07 | .1031E+01 | .1452E+02 | .8718E+04 |
| vinylchloride | .6664E+05 | .1352E+01 | .1904E+02 | .4870E+03 |
| Ethylbenzene | .2151E+07 | .1138E+01 | .1603E+02 | .1572E+05 |

RESULTS AT TIME (DAYS) 1098.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1622E+03 | .6784E+06 | .3721E+03 | .1793E+04 |
| toluene | .1287E+04 | .1857E+08 | .2499E+04 | .4371E+05 |
| p-xylene | .1404E+03 | .6827E+07 | .3063E+03 | .1545E+05 |
| 111-trichloroethane | .1295E+03 | .3345E+07 | .9044E+03 | .1020E+05 |
| 1122-tetrachloroethane | .3610E+03 | .2158E+08 | .8971E+04 | .7847E+05 |
| 112-trichloroethane | .6979E+02 | .7299E+06 | .5925E+03 | .6239E+04 |
| 11-dichoroethane | .3240E+03 | .5648E+06 | .4107E+03 | .9047E+03 |
| 11-dichoroethene | .5173E+03 | .2739E+06 | .1530E+03 | .3780E+03 |
| methylenechloride | .9429E+03 | .8286E+06 | .3737E+03 | .2669E+03 |
| tetrachloroethene | .1220E+02 | .2127E+07 | .4631E+02 | .6580E+03 |
| trichloroethene | .2123E+03 | .1168E+07 | .2354E+03 | .2017E+04 |
| vinylacetate | .3995E+03 | .1114E+07 | .6235E+03 | .1113E+02 |
| vinylchloride | .1147E+03 | .1370E+05 | .4930E+02 | .4224E+02 |
| Ethylbenzene | .4529E+03 | .2059E+07 | .7060E+02 | .3554E+04 |

TOTAL MASS IN ALL PHASE = .6006E+05

TOTAL MASS IN GAS PHASE (kg) = .5126E+01
TOTAL MASS IN FREE PHASE (kg) = .5988E+05
TOTAL MASS IN WATER PHASE (kg) = .1561E+02
TOTAL MASS IN SOIL PHASE (kg) = .1637E+03

| SPECIES S | MASS g | CONC WELL GAS g/m3 | CONC SOIL GAS g/m3 | CONC SOIL MAS mg/k g |
|---|---|---|---|---|
| benzene | .6808E+06 | .3992E+00 | .5622E+01 | .4975E+04 |
| toluene | .1862E+08 | .3167E+01 | .4460E+02 | .1360E+06 |
| p-xylene | .6843E+07 | .3452E+00 | .4862E+01 | .5001E+05 |
| 111-trichloroethane | .3356E+07 | .3186E+00 | .4487E+01 | .2452E+05 |
| 1122-tetrachloroethane | .2166E+08 | .8890E+00 | .1252E+02 | .1583E+06 |
| 112-trichloroethane | .7368E+06 | .1717E+00 | .2419E+01 | .5384E+04 |
| 11-dichoroethane | .5664E+06 | .7982E+00 | .1124E+02 | .4139E+04 |
| 11-dichoroethene | .2750E+06 | .1279E+01 | .1801E+02 | .2009E+04 |
| methylenechloride | .8302E+06 | .2326E+01 | .3276E+02 | .6066E+04 |
| tetrachloroethene | .2128E+07 | .3001E-01 | .4227E+00 | .1555E+05 |
| trichloroethene | .1171E+07 | .5224E+00 | .7357E+01 | .8555E+04 |
| vinylacetate | .1115E+07 | .9836E+00 | .1385E+02 | .8149E+04 |
| vinylchloride | .1391E+05 | .2882E+00 | .4059E+01 | .1017E+03 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .2064E+07 | .1115E+01 | .1570E+02 | .1508E+05 |

RESULTS AT TIME (DAYS) 1463.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1577E+03 | .6480E+06 | .3619E+03 | .1744E+04 |
| toluene | .1293E+04 | .1832E+08 | .2510E+04 | .4391E+05 |
| p-xylene | .1423E+03 | .6799E+07 | .3106E+03 | .1567E+05 |
| 111-trichloroethane | .1309E+03 | .3320E+07 | .9139E+03 | .1031E+05 |
| 1122-tetrachloroethane | .3664E+03 | .2150E+08 | .9103E+04 | .7962E+05 |
| 112-trichloroethane | .6976E+02 | .7165E+06 | .5922E+03 | .6237E+04 |
| 11-dichoroethane | .2956E+03 | .5060E+06 | .3747E+03 | .8252E+03 |
| 11-dichoroethene | .3669E+03 | .1908E+06 | .1085E+03 | .2680E+03 |
| methylenechloride | .7718E+03 | .6662E+06 | .3060E+03 | .2184E+03 |
| tetrachloroethene | .1241E+02 | .2124E+07 | .4709E+02 | .6691E+03 |
| trichloroethene | .2087E+03 | .1128E+07 | .2314E+03 | .1983E+04 |
| vinylacetate | .3797E+03 | .1040E+07 | .5926E+03 | .1058E+02 |
| vinylchloride | .2364E+02 | .2775E+04 | .1017E+02 | .8712E+01 |
| Ethylbenzene | .4421E+03 | .1974E+07 | .6891E+02 | .3469E+04 |

TOTAL MASS IN ALL PHASE = .5912E+05

TOTAL MASS IN GAS PHASE (kg) = .4661E+01
TOTAL MASS IN FREE PHASE (kg) = .5894E+05
TOTAL MASS IN WATER PHASE (kg) = .1553E+02
TOTAL MASS IN SOIL PHASE (kg) = .1649E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .6503E+06 | .3882E+00 | .5468E+01 | .4752E+04 |
| toluene | .1837E+08 | .3182E+01 | .4481E+02 | .1342E+06 |
| p-xylene | .6815E+07 | .3503E+00 | .4934E+01 | .4980E+05 |
| 111-trichloroethane | .3331E+07 | .3220E+00 | .4535E+01 | .2434E+05 |
| 1122-tetrachloroethane | .2159E+08 | .9014E+00 | .1270E+02 | .1578E+06 |
| 112-trichloroethane | .7234E+06 | .1717E+00 | .2418E+01 | .5286E+04 |
| 11-dichoroethane | .5075E+06 | .7281E+00 | .1026E+02 | .3708E+04 |
| 11-dichoroethene | .1915E+06 | .9069E+00 | .1277E+02 | .1400E+04 |
| methylenechloride | .6675E+06 | .1904E+01 | .2682E+02 | .4877E+04 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .2125E+07 | .3062E-01 | .4313E+00 | .1553E+05 |
| trichloroethene | .1131E+07 | .5136E+00 | .7234E+01 | .8262E+04 |
| vinylacetate | .1041E+07 | .9349E+00 | .1317E+02 | .7607E+04 |
| vinylchloride | .2819E+04 | .5945E-01 | .8374E+00 | .2060E+02 |
| Ethylbenzene | .1978E+07 | .1088E+01 | .1532E+02 | .1446E+05 |

RESULTS AT TIME (DAYS) 1828.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1531E+03 | .6184E+06 | .3512E+03 | .1693E+04 |
| toluene | .1297E+04 | .1807E+08 | .2518E+04 | .4405E+05 |
| p-xylene | .1441E+03 | .6771E+07 | .3145E+03 | .1587E+05 |
| 111-trichloroethane | .1321E+03 | .3294E+07 | .9222E+03 | .1040E+05 |
| 1122-tetrachloroethane | .3713E+03 | .2143E+08 | .9225E+04 | .8069E+05 |
| 112-trichloroethane | .6962E+02 | .7031E+06 | .5910E+03 | .6224E+04 |
| 11-dichoroethane | .2688E+03 | .4524E+06 | .3407E+03 | .7504E+03 |
| 11-dichoroethene | .2582E+03 | .1320E+06 | .7636E+02 | .1887E+03 |
| methylenechloride | .6286E+03 | .5335E+06 | .2492E+03 | .1779E+03 |
| tetrachloroethene | .1260E+02 | .2122E+07 | .4783E+02 | .6796E+03 |
| trichloroethene | .2048E+03 | .1089E+07 | .2271E+03 | .1946E+04 |
| vinylacetate | .3600E+03 | .9696E+06 | .5618E+03 | .1003E+02 |
| vinylchloride | .4736E+01 | .5467E+03 | .2037E+01 | .1745E+01 |
| Ethylbenzene | .4306E+03 | .1891E+07 | .6712E+02 | .3379E+04 |

TOTAL MASS IN ALL PHASE = .5826E+05

TOTAL MASS IN GAS PHASE (kg) = .4336E+01
TOTAL MASS IN FREE PHASE (kg) = .5808E+05
TOTAL MASS IN WATER PHASE (kg) = .1549E+02
TOTAL MASS IN SOIL PHASE (kg) = .1661E+03

| SPECIES<br>S | MASS<br>g | CONC<br>WELL GAS<br>g/m3 | CONC<br>SOIL GAS<br>g/m3 | CONC<br>SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .6206E+06 | .3768E+00 | .5307E+01 | .4535E+04 |
| toluene | .1812E+08 | .3191E+01 | .4494E+02 | .1324E+06 |
| p-xylene | .6787E+07 | .3546E+00 | .4995E+01 | .4959E+05 |
| 111-trichloroethane | .3305E+07 | .3250E+00 | .4577E+01 | .2415E+05 |
| 1122-tetrachloroethane | .2152E+08 | .9138E+00 | .1287E+02 | .1572E+06 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .7100E+06 | .1713E+00 | .2413E+01 | .5188E+04 |
| 11-dichoroethane | .4538E+06 | .6621E+00 | .9326E+01 | .3316E+04 |
| 11-dichoroethene | .1326E+06 | .6384E+00 | .8991E+01 | .9687E+03 |
| methylenechloride | .5346E+06 | .1551E+01 | .2185E+02 | .3906E+04 |
| tetrachloroethene | .2122E+07 | .3093E-01 | .4356E+00 | .1551E+05 |
| trichloroethene | .1091E+07 | .5041E+00 | .7099E+01 | .7973E+04 |
| vinylacetate | .9705E+06 | .8863E+00 | .1248E+02 | .7092E+04 |
| vinylchloride | .5554E+03 | .1191E-01 | .1678E+00 | .4058E+01 |
| Ethylbenzene | .1895E+07 | .1060E+01 | .1493E+02 | .1385E+05 |

RESULTS AT TIME (DAYS) 2193.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1483E+03 | .5898E+06 | .3403E+03 | .1640E+04 |
| toluene | .1300E+04 | .1782E+08 | .2523E+04 | .4414E+05 |
| p-xylene | .1458E+03 | .6742E+07 | .3182E+03 | .1605E+05 |
| 111-trichloroethane | .1332E+03 | .3268E+07 | .9296E+03 | .1049E+05 |
| 1122-tetrachloroethane | .3759E+03 | .2135E+08 | .9340E+04 | .8170E+05 |
| 112-trichloroethane | .6940E+02 | .6898E+06 | .5891E+03 | .6204E+04 |
| 11-dichoroethane | .2437E+03 | .4038E+06 | .3090E+03 | .6805E+03 |
| 11-dichoroethene | .1805E+03 | .9084E+05 | .5338E+02 | .1319E+03 |
| methylenechloride | .5097E+03 | .4258E+06 | .2020E+03 | .1443E+03 |
| tetrachloroethene | .1279E+02 | .2119E+07 | .4853E+02 | .6896E+03 |
| trichloroethene | .2007E+03 | .1050E+07 | .2226E+03 | .1907E+04 |
| vinylacetate | .3406E+03 | .9029E+06 | .5316E+03 | .9489E+01 |
| vinylchloride | .9230E+00 | .1049E+03 | .3969E+00 | .3401E+00 |
| Ethylbenzene | .4188E+03 | .1810E+07 | .6528E+02 | .3286E+04 |

TOTAL MASS IN ALL PHASE = .5745E+05

TOTAL MASS IN GAS PHASE (kg) = .4080E+01
TOTAL MASS IN FREE PHASE (kg) = .5727E+05
TOTAL MASS IN WATER PHASE (kg) = .1547E+02
TOTAL MASS IN SOIL PHASE (kg) = .1671E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .5919E+06 | .3651E+00 | .5142E+01 | .4325E+04 |

| | | | | |
|---|---|---|---|---|
| toluene | .1787E+08 | .3198E+01 | .4504E+02 | .1306E+06 |
| p-xylene | .6758E+07 | .3585E+00 | .5050E+01 | .4938E+05 |
| 111-trichloroethane | .3280E+07 | .3277E+00 | .4615E+01 | .2396E+05 |
| 1122-tetrachloroethane | .2144E+08 | .9249E+00 | .1303E+02 | .1567E+06 |
| 112-trichloroethane | .6967E+06 | .1707E+00 | .2405E+01 | .5091E+04 |
| 11-dichoroethane | .4051E+06 | .6005E+00 | .8458E+01 | .2960E+04 |
| 11-dichoroethene | .9121E+05 | .4462E+00 | .6285E+01 | .6665E+03 |
| methylenechloride | .4266E+06 | .1258E+01 | .1771E+02 | .3117E+04 |
| tetrachloroethene | .2120E+07 | .3154E-01 | .4442E+00 | .1549E+05 |
| trichloroethene | .1052E+07 | .4940E+00 | .6957E+01 | .7690E+04 |
| vinylacetate | .9038E+06 | .8387E+00 | .1181E+02 | .6604E+04 |
| vinylchloride | .1066E+03 | .2323E-02 | .3271E-01 | .7786E+00 |
| Ethylbenzene | .1814E+07 | .1031E+01 | .1452E+02 | .1325E+05 |

RESULTS AT TIME (DAYS) 2558.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1435E+03 | .5620E+06 | .3293E+03 | .1587E+04 |
| toluene | .1301E+04 | .1757E+08 | .2526E+04 | .4419E+05 |
| p-xylene | .1474E+03 | .6713E+07 | .3217E+03 | .1623E+05 |
| 111-trichloroethane | .1341E+03 | .3242E+07 | .9364E+03 | .1056E+05 |
| 1122-tetrachloroethane | .3803E+03 | .2127E+08 | .9450E+04 | .8266E+05 |
| 112-trichloroethane | .6911E+02 | .6766E+06 | .5867E+03 | .6179E+04 |
| 11-dichoroethane | .2205E+03 | .3598E+06 | .2795E+03 | .6157E+03 |
| 11-dichoroethene | .1253E+03 | .6213E+05 | .3707E+02 | .9157E+02 |
| methylenechloride | .4115E+03 | .3385E+06 | .1631E+03 | .1165E+03 |
| tetrachloroethene | .1297E+02 | .2116E+07 | .4921E+02 | .6993E+03 |
| trichloroethene | .1965E+03 | .1012E+07 | .2178E+03 | .1866E+04 |
| vinylacetate | .3217E+03 | .8399E+06 | .5021E+03 | .8963E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .4068E+03 | .1732E+07 | .6341E+02 | .3192E+04 |

TOTAL MASS IN ALL PHASE = .5669E+05

TOTAL MASS IN GAS PHASE (kg) = .3871E+01
TOTAL MASS IN FREE PHASE (kg) = .5650E+05
TOTAL MASS IN WATER PHASE (kg) = .1546E+02
TOTAL MASS IN SOIL PHASE (kg) = .1680E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|

S

| | g | g/m3 | g/m3 | mg/kg |
|---|---|---|---|---|
| benzene | .5641E+06 | .3533E+00 | .4975E+01 | .4122E+04 |
| toluene | .1762E+08 | .3202E+01 | .4510E+02 | .1288E+06 |
| p-xylene | .6729E+07 | .3629E+00 | .5111E+01 | .4917E+05 |
| 111-trichloroethane | .3254E+07 | .3299E+00 | .4646E+01 | .2378E+05 |
| 1122-tetrachloroethane | .2137E+08 | .9361E+00 | .1318E+02 | .1561E+06 |
| 112-trichloroethane | .6834E+06 | .1701E+00 | .2395E+01 | .4994E+04 |
| 11-dichoroethane | .3609E+06 | .5433E+00 | .7652E+01 | .2637E+04 |
| 11-dichoroethene | .6238E+05 | .3099E+00 | .4365E+01 | .4558E+03 |
| methylenechloride | .3392E+06 | .1015E+01 | .1430E+02 | .2479E+04 |
| tetrachloroethene | .2117E+07 | .3185E-01 | .4485E+00 | .1547E+05 |
| trichloroethene | .1015E+07 | .4835E+00 | .6810E+01 | .7413E+04 |
| vinylacetate | .8407E+06 | .7922E+00 | .1116E+02 | .6143E+04 |
| vinylchloride | .2882E+02 | .0000E+00 | .0000E+00 | .2106E+00 |
| Ethylbenzene | .1735E+07 | .1001E+01 | .1410E+02 | .1268E+05 |

RESULTS AT TIME (DAYS) 2923.606000

| SPECIES | .........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1387E+03 | .5352E+06 | .3182E+03 | .1534E+04 |
| toluene | .1302E+04 | .1732E+08 | .2527E+04 | .4421E+05 |
| p-xylene | .1490E+03 | .6683E+07 | .3251E+03 | .1640E+05 |
| 111-trichloroethane | .1350E+03 | .3216E+07 | .9427E+03 | .1063E+05 |
| 1122-tetrachloroethane | .3846E+03 | .2120E+08 | .9556E+04 | .8358E+05 |
| 112-trichloroethane | .6878E+02 | .6634E+06 | .5839E+03 | .6149E+04 |
| 11-dichoroethane | .1990E+03 | .3200E+06 | .2523E+03 | .5557E+03 |
| 11-dichoroethene | .8650E+02 | .4224E+05 | .2558E+02 | .6320E+02 |
| methylenechloride | .3310E+03 | .2683E+06 | .1312E+03 | .9367E+02 |
| tetrachloroethene | .1315E+02 | .2113E+07 | .4988E+02 | .7087E+03 |
| trichloroethene | .1921E+03 | .9752E+06 | .2130E+03 | .1825E+04 |
| vinylacetate | .3034E+03 | .7804E+06 | .4735E+03 | .8452E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3947E+03 | .1655E+07 | .6152E+02 | .3097E+04 |

TOTAL MASS IN ALL PHASE = .5596E+05

TOTAL MASS IN GAS PHASE (kg) = .3698E+01
TOTAL MASS IN FREE PHASE (kg) = .5577E+05
TOTAL MASS IN WATER PHASE (kg) = .1546E+02
TOTAL MASS IN SOIL PHASE (kg) = .1689E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .5372E+06 | .3414E+00 | .4808E+01 | .3925E+04 |
| toluene | .1737E+08 | .3203E+01 | .4512E+02 | .1269E+06 |
| p-xylene | .6700E+07 | .3664E+00 | .5160E+01 | .4896E+05 |
| 111-trichloroethane | .3228E+07 | .3321E+00 | .4678E+01 | .2358E+05 |
| 1122-tetrachloroethane | .2129E+08 | .9460E+00 | .1332E+02 | .1556E+06 |
| 112-trichloroethane | .6702E+06 | .1692E+00 | .2383E+01 | .4897E+04 |
| 11-dichoroethane | .3210E+06 | .4904E+00 | .6907E+01 | .2346E+04 |
| 11-dichoroethene | .4242E+05 | .2139E+00 | .3013E+01 | .3100E+03 |
| methylenechloride | .2688E+06 | .8167E+00 | .1150E+02 | .1964E+04 |
| tetrachloroethene | .2114E+07 | .3231E-01 | .4550E+00 | .1545E+05 |
| trichloroethene | .9775E+06 | .4727E+00 | .6658E+01 | .7143E+04 |
| vinylacetate | .7812E+06 | .7471E+00 | .1052E+02 | .5708E+04 |
| vinylchloride | .2881E+02 | .0000E+00 | .0000E+00 | .2106E+00 |
| Ethylbenzene | .1659E+07 | .9714E+00 | .1368E+02 | .1212E+05 |

RESULTS AT TIME (DAYS) 3288.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1339E+03 | .5092E+06 | .3072E+03 | .1480E+04 |
| toluene | .1302E+04 | .1707E+08 | .2527E+04 | .4420E+05 |
| p-xylene | .1504E+03 | .6653E+07 | .3283E+03 | .1656E+05 |
| 111-trichloroethane | .1359E+03 | .3189E+07 | .9485E+03 | .1070E+05 |
| 1122-tetrachloroethane | .3887E+03 | .2112E+08 | .9659E+04 | .8448E+05 |
| 112-trichloroethane | .6839E+02 | .6503E+06 | .5806E+03 | .6115E+04 |
| 11-dichoroethane | .1793E+03 | .2841E+06 | .2272E+03 | .5005E+03 |
| 11-dichoroethene | .5933E+02 | .2856E+05 | .1755E+02 | .4335E+02 |
| methylenechloride | .2651E+03 | .2119E+06 | .1051E+03 | .7504E+02 |
| tetrachloroethene | .1332E+02 | .2110E+07 | .5053E+02 | .7180E+03 |
| trichloroethene | .1876E+03 | .9390E+06 | .2081E+03 | .1783E+04 |
| vinylacetate | .2857E+03 | .7244E+06 | .4459E+03 | .7959E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3825E+03 | .1581E+07 | .5962E+02 | .3001E+04 |

TOTAL MASS IN ALL PHASE = .5526E+05

TOTAL MASS IN GAS PHASE (kg) = .3552E+01
TOTAL MASS IN FREE PHASE (kg) = .5507E+05
TOTAL MASS IN WATER PHASE (kg) = .1546E+02

TOTAL MASS IN SOIL PHASE (kg) = .1697E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .5112E+06 | .3296E+00 | .4642E+01 | .3735E+04 |
| toluene | .1712E+08 | .3202E+01 | .4510E+02 | .1251E+06 |
| p-xylene | .6670E+07 | .3699E+00 | .5210E+01 | .4874E+05 |
| 111-trichloroethane | .3201E+07 | .3341E+00 | .4706E+01 | .2339E+05 |
| 1122-tetrachloroethane | .2121E+08 | .9559E+00 | .1346E+02 | .1550E+06 |
| 112-trichloroethane | .6571E+06 | .1683E+00 | .2370E+01 | .4801E+04 |
| 11-dichoroethane | .2850E+06 | .4417E+00 | .6221E+01 | .2083E+04 |
| 11-dichoroethene | .2869E+05 | .1467E+00 | .2067E+01 | .2096E+03 |
| methylenechloride | .2123E+06 | .6543E+00 | .9216E+01 | .1551E+04 |
| tetrachloroethene | .2111E+07 | .3277E-01 | .4615E+00 | .1543E+05 |
| trichloroethene | .9412E+06 | .4618E+00 | .6505E+01 | .6878E+04 |
| vinylacetate | .7251E+06 | .7035E+00 | .9908E+01 | .5298E+04 |
| vinylchloride | .2813E+02 | .0000E+00 | .0000E+00 | .2055E+00 |
| Ethylbenzene | .1585E+07 | .9414E+00 | .1326E+02 | .1158E+05 |

RESULTS AT TIME (DAYS) 3653.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1291E+03 | .4842E+06 | .2962E+03 | .1428E+04 |
| toluene | .1301E+04 | .1682E+08 | .2525E+04 | .4417E+05 |
| p-xylene | .1519E+03 | .6623E+07 | .3315E+03 | .1672E+05 |
| 111-trichloroethane | .1366E+03 | .3163E+07 | .9539E+03 | .1076E+05 |
| 1122-tetrachloroethane | .3927E+03 | .2104E+08 | .9759E+04 | .8535E+05 |
| 112-trichloroethane | .6797E+02 | .6373E+06 | .5770E+03 | .6077E+04 |
| 11-dichoroethane | .1612E+03 | .2518E+06 | .2043E+03 | .4499E+03 |
| 11-dichoroethene | .4046E+02 | .1921E+05 | .1197E+02 | .2956E+02 |
| methylenechloride | .2116E+03 | .1667E+06 | .8389E+02 | .5990E+02 |
| tetrachloroethene | .1349E+02 | .2107E+07 | .5118E+02 | .7271E+03 |
| trichloroethene | .1831E+03 | .9037E+06 | .2031E+03 | .1740E+04 |
| vinylacetate | .2686E+03 | .6716E+06 | .4192E+03 | .7484E+01 |
| vinylchloride | .2625E+00 | .2812E+02 | .1129E+00 | .9670E-01 |
| Ethylbenzene | .3703E+03 | .1510E+07 | .5772E+02 | .2905E+04 |

TOTAL MASS IN ALL PHASE = .5459E+05

| | | |
|---|---|---|
| TOTAL MASS IN GAS PHASE (kg) | = | .3428E+01 |
| TOTAL MASS IN FREE PHASE (kg) | = | .5440E+05 |
| TOTAL MASS IN WATER PHASE (kg) | = | .1547E+02 |
| TOTAL MASS IN SOIL PHASE (kg) | = | .1704E+03 |

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .4861E+06 | .3178E+00 | .4477E+01 | .3552E+04 |
| toluene | .1687E+08 | .3201E+01 | .4508E+02 | .1233E+06 |
| p-xylene | .6640E+07 | .3738E+00 | .5265E+01 | .4852E+05 |
| 111-trichloroethane | .3175E+07 | .3361E+00 | .4733E+01 | .2320E+05 |
| 1122-tetrachloroethane | .2114E+08 | .9659E+00 | .1360E+02 | .1544E+06 |
| 112-trichloroethane | .6440E+06 | .1673E+00 | .2356E+01 | .4706E+04 |
| 11-dichoroethane | .2526E+06 | .3971E+00 | .5593E+01 | .1846E+04 |
| 11-dichoroethene | .1929E+05 | .1001E+00 | .1409E+01 | .1409E+03 |
| methylenechloride | .1671E+06 | .5223E+00 | .7356E+01 | .1221E+04 |
| tetrachloroethene | .2108E+07 | .3307E-01 | .4658E+00 | .1541E+05 |
| trichloroethene | .9058E+06 | .4507E+00 | .6348E+01 | .6619E+04 |
| vinylacetate | .6723E+06 | .6615E+00 | .9316E+01 | .4913E+04 |
| vinylchloride | .2812E+02 | .0000E+00 | .0000E+00 | .2055E+00 |
| Ethylbenzene | .1513E+07 | .9115E+00 | .1284E+02 | .1105E+05 |

RESULTS AT TIME (DAYS) 4018.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1244E+03 | .4601E+06 | .2854E+03 | .1375E+04 |
| toluene | .1299E+04 | .1657E+08 | .2522E+04 | .4411E+05 |
| p-xylene | .1533E+03 | .6593E+07 | .3345E+03 | .1687E+05 |
| 111-trichloroethane | .1374E+03 | .3136E+07 | .9590E+03 | .1082E+05 |
| 1122-tetrachloroethane | .3967E+03 | .2096E+08 | .9857E+04 | .8621E+05 |
| 112-trichloroethane | .6752E+02 | .6243E+06 | .5732E+03 | .6036E+04 |
| 11-dichoroethane | .1446E+03 | .2228E+06 | .1833E+03 | .4037E+03 |
| 11-dichoroethene | .2743E+02 | .1284E+05 | .8112E+01 | .2004E+02 |
| methylenechloride | .1683E+03 | .1308E+06 | .6672E+02 | .4764E+02 |
| tetrachloroethene | .1365E+02 | .2104E+07 | .5181E+02 | .7362E+03 |
| trichloroethene | .1786E+03 | .8692E+06 | .1980E+03 | .1697E+04 |
| vinylacetate | .2523E+03 | .6221E+06 | .3937E+03 | .7027E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .3582E+03 | .1440E+07 | .5583E+02 | .2810E+04 |

TOTAL MASS IN ALL PHASE = .5394E+05

TOTAL MASS IN GAS PHASE (kg) = .3321E+01
TOTAL MASS IN FREE PHASE (kg) = .5375E+05
TOTAL MASS IN WATER PHASE (kg) = .1549E+02
TOTAL MASS IN SOIL PHASE (kg) = .1711E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .4619E+06 | .3062E+00 | .4313E+01 | .3375E+04 |
| toluene | .1662E+08 | .3197E+01 | .4502E+02 | .1214E+06 |
| p-xylene | .6610E+07 | .3770E+00 | .5310E+01 | .4830E+05 |
| 111-trichloroethane | .3148E+07 | .3380E+00 | .4761E+01 | .2300E+05 |
| 1122-tetrachloroethane | .2106E+08 | .9770E+00 | .1376E+02 | .1539E+06 |
| 112-trichloroethane | .6310E+06 | .1661E+00 | .2340E+01 | .4611E+04 |
| 11-dichoroethane | .2236E+06 | .3562E+00 | .5017E+01 | .1634E+04 |
| 11-dichoroethene | .1290E+05 | .6785E-01 | .9556E+00 | .9426E+02 |
| methylenechloride | .1311E+06 | .4154E+00 | .5851E+01 | .9578E+03 |
| tetrachloroethene | .2105E+07 | .3353E-01 | .4723E+00 | .1538E+05 |
| trichloroethene | .8713E+06 | .4396E+00 | .6191E+01 | .6367E+04 |
| vinylacetate | .6227E+06 | .6212E+00 | .8749E+01 | .4550E+04 |
| vinylchloride | .2743E+02 | .0000E+00 | .0000E+00 | .2005E+00 |
| Ethylbenzene | .1443E+07 | .8817E+00 | .1242E+02 | .1055E+05 |

RESULTS AT TIME (DAYS) 4383.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1197E+03 | .4369E+06 | .2747E+03 | .1324E+04 |
| toluene | .1297E+04 | .1632E+08 | .2518E+04 | .4404E+05 |
| p-xylene | .1547E+03 | .6562E+07 | .3375E+03 | .1702E+05 |
| 111-trichloroethane | .1380E+03 | .3109E+07 | .9638E+03 | .1087E+05 |
| 1122-tetrachloroethane | .4005E+03 | .2088E+08 | .9953E+04 | .8705E+05 |
| 112-trichloroethane | .6703E+02 | .6115E+06 | .5690E+03 | .5993E+04 |
| 11-dichoroethane | .1295E+03 | .1969E+06 | .1641E+03 | .3615E+03 |
| 11-dichoroethene | .1849E+02 | .8540E+04 | .5468E+01 | .1351E+02 |
| methylenechloride | .1334E+03 | .1023E+06 | .5287E+02 | .3775E+02 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .1382E+02 | .2101E+07 | .5245E+02 | .7452E+03 |
| trichloroethene | .1740E+03 | .8356E+06 | .1930E+03 | .1653E+04 |
| vinylacetate | .2366E+03 | .5756E+06 | .3692E+03 | .6591E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3462E+03 | .1373E+07 | .5396E+02 | .2716E+04 |

TOTAL MASS IN ALL PHASE = .5331E+05

TOTAL MASS IN GAS PHASE (kg) = .3229E+01
TOTAL MASS IN FREE PHASE (kg) = .5312E+05
TOTAL MASS IN WATER PHASE (kg) = .1551E+02
TOTAL MASS IN SOIL PHASE (kg) = .1718E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .4386E+06 | .2947E+00 | .4151E+01 | .3205E+04 |
| toluene | .1637E+08 | .3191E+01 | .4494E+02 | .1196E+06 |
| p-xylene | .6580E+07 | .3805E+00 | .5359E+01 | .4808E+05 |
| 111-trichloroethane | .3121E+07 | .3398E+00 | .4785E+01 | .2281E+05 |
| 1122-tetrachloroethane | .2098E+08 | .9857E+00 | .1388E+02 | .1533E+06 |
| 112-trichloroethane | .6181E+06 | .1649E+00 | .2323E+01 | .4517E+04 |
| 11-dichoroethane | .1975E+06 | .3190E+00 | .4493E+01 | .1443E+04 |
| 11-dichoroethene | .8578E+04 | .4574E-01 | .6442E+00 | .6268E+02 |
| methylenechloride | .1025E+06 | .3292E+00 | .4637E+01 | .7488E+03 |
| tetrachloroethene | .2102E+07 | .3399E-01 | .4787E+00 | .1536E+05 |
| trichloroethene | .8377E+06 | .4283E+00 | .6033E+01 | .6121E+04 |
| vinylacetate | .5762E+06 | .5826E+00 | .8206E+01 | .4210E+04 |
| vinylchloride | .2675E+02 | .0000E+00 | .0000E+00 | .1954E+00 |
| Ethylbenzene | .1376E+07 | .8521E+00 | .1200E+02 | .1006E+05 |

RESULTS AT TIME (DAYS) 4748.606000

| SPECIES | ........MASS (g) IN PHASES ....<br>GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1151E+03 | .4146E+06 | .2642E+03 | .1273E+04 |
| toluene | .1294E+04 | .1607E+08 | .2513E+04 | .4395E+05 |
| p-xylene | .1560E+03 | .6531E+07 | .3404E+03 | .1717E+05 |
| 111-trichloroethane | .1387E+03 | .3083E+07 | .9683E+03 | .1092E+05 |
| 1122-tetrachloroethane | .4044E+03 | .2080E+08 | .1005E+05 | .8788E+05 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .6652E+02 | .5987E+06 | .5647E+03 | .5947E+04 |
| 11-dichoroethane | .1157E+03 | .1736E+06 | .1467E+03 | .3231E+03 |
| 11-dichoroethene | .1239E+02 | .5648E+04 | .3665E+01 | .9054E+01 |
| methylenechloride | .1053E+03 | .7968E+05 | .4175E+02 | .2981E+02 |
| tetrachloroethene | .1399E+02 | .2098E+07 | .5307E+02 | .7541E+03 |
| trichloroethene | .1695E+03 | .8029E+06 | .1879E+03 | .1610E+04 |
| vinylacetate | .2216E+03 | .5320E+06 | .3459E+03 | .6174E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3343E+03 | .1308E+07 | .5211E+02 | .2623E+04 |

TOTAL MASS IN ALL PHASE = .5269E+05

TOTAL MASS IN GAS PHASE (kg) = .3148E+01
TOTAL MASS IN FREE PHASE (kg) = .5250E+05
TOTAL MASS IN WATER PHASE (kg) = .1553E+02
TOTAL MASS IN SOIL PHASE (kg) = .1725E+03

| SPECIES S | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .4162E+06 | .2834E+00 | .3992E+01 | .3042E+04 |
| toluene | .1612E+08 | .3184E+01 | .4485E+02 | .1178E+06 |
| p-xylene | .6549E+07 | .3837E+00 | .5404E+01 | .4785E+05 |
| 111-trichloroethane | .3095E+07 | .3412E+00 | .4806E+01 | .2261E+05 |
| 1122-tetrachloroethane | .2090E+08 | .9944E+00 | .1401E+02 | .1527E+06 |
| 112-trichloroethane | .6053E+06 | .1637E+00 | .2305E+01 | .4423E+04 |
| 11-dichoroethane | .1742E+06 | .2851E+00 | .4016E+01 | .1273E+04 |
| 11-dichoroethene | .5673E+04 | .3066E-01 | .4318E+00 | .4146E+02 |
| methylenechloride | .7985E+05 | .2600E+00 | .3662E+01 | .5835E+03 |
| tetrachloroethene | .2099E+07 | .3430E-01 | .4830E+00 | .1534E+05 |
| trichloroethene | .8049E+06 | .4171E+00 | .5875E+01 | .5881E+04 |
| vinylacetate | .5325E+06 | .5457E+00 | .7686E+01 | .3891E+04 |
| vinylchloride | .2674E+02 | .0000E+00 | .0000E+00 | .1954E+00 |
| Ethylbenzene | .1311E+07 | .8228E+00 | .1159E+02 | .9582E+04 |

RESULTS AT TIME (DAYS) 5113.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .1106E+03 | .3931E+06 | .2538E+03 | .1223E+04 |

| | | | | |
|---|---|---|---|---|
| toluene | .1291E+04 | .1582E+08 | .2507E+04 | .4385E+05 |
| p-xylene | .1573E+03 | .6500E+07 | .3433E+03 | .1732E+05 |
| 111-trichloroethane | .1393E+03 | .3056E+07 | .9726E+03 | .1097E+05 |
| 1122-tetrachloroethane | .4081E+03 | .2072E+08 | .1014E+05 | .8870E+05 |
| 112-trichloroethane | .6598E+02 | .5861E+06 | .5601E+03 | .5899E+04 |
| 11-dichoroethane | .1032E+03 | .1528E+06 | .1309E+03 | .2882E+03 |
| 11-dichoroethene | .8259E+01 | .3715E+04 | .2443E+01 | .6034E+01 |
| methylenechloride | .8289E+02 | .6188E+05 | .3286E+02 | .2346E+02 |
| tetrachloroethene | .1415E+02 | .2095E+07 | .5370E+02 | .7630E+03 |
| trichloroethene | .1649E+03 | .7711E+06 | .1829E+03 | .1567E+04 |
| vinylacetate | .2073E+03 | .4912E+06 | .3236E+03 | .5776E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3226E+03 | .1246E+07 | .5028E+02 | .2531E+04 |

TOTAL MASS IN ALL PHASE = .5209E+05

TOTAL MASS IN GAS PHASE (kg) = .3076E+01
TOTAL MASS IN FREE PHASE (kg) = .5190E+05
TOTAL MASS IN WATER PHASE (kg) = .1555E+02
TOTAL MASS IN SOIL PHASE (kg) = .1731E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .3947E+06 | .2724E+00 | .3836E+01 | .2884E+04 |
| toluene | .1587E+08 | .3177E+01 | .4475E+02 | .1160E+06 |
| p-xylene | .6518E+07 | .3872E+00 | .5453E+01 | .4763E+05 |
| 111-trichloroethane | .3068E+07 | .3427E+00 | .4827E+01 | .2242E+05 |
| 1122-tetrachloroethane | .2082E+08 | .1004E+01 | .1414E+02 | .1521E+06 |
| 112-trichloroethane | .5926E+06 | .1623E+00 | .2286E+01 | .4331E+04 |
| 11-dichoroethane | .1534E+06 | .2544E+00 | .3583E+01 | .1121E+04 |
| 11-dichoroethene | .3731E+04 | .2043E-01 | .2878E+00 | .2727E+02 |
| methylenechloride | .6202E+05 | .2046E+00 | .2882E+01 | .4532E+03 |
| tetrachloroethene | .2096E+07 | .3476E-01 | .4895E+00 | .1532E+05 |
| trichloroethene | .7730E+06 | .4059E+00 | .5717E+01 | .5648E+04 |
| vinylacetate | .4917E+06 | .5106E+00 | .7191E+01 | .3593E+04 |
| vinylchloride | .2606E+02 | .0000E+00 | .0000E+00 | .1904E+00 |
| Ethylbenzene | .1249E+07 | .7939E+00 | .1118E+02 | .9125E+04 |

RESULTS AT TIME (DAYS) 5478.606000

SPECIES ........MASS (g) IN PHASES ....

| | GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1062E+03 | .3725E+06 | .2437E+03 | .1174E+04 |
| toluene | .1288E+04 | .1558E+08 | .2500E+04 | .4373E+05 |
| p-xylene | .1586E+03 | .6469E+07 | .3462E+03 | .1746E+05 |
| 111-trichloroethane | .1399E+03 | .3028E+07 | .9767E+03 | .1102E+05 |
| 1122-tetrachloroethane | .4119E+03 | .2063E+08 | .1023E+05 | .8951E+05 |
| 112-trichloroethane | .6542E+02 | .5736E+06 | .5554E+03 | .5849E+04 |
| 11-dichoroethane | .9194E+02 | .1343E+06 | .1165E+03 | .2567E+03 |
| 11-dichoroethene | .5473E+01 | .2430E+04 | .1619E+01 | .3999E+01 |
| methylenechloride | .6500E+02 | .4789E+05 | .2577E+02 | .1840E+02 |
| tetrachloroethene | .1432E+02 | .2092E+07 | .5433E+02 | .7720E+03 |
| trichloroethene | .1604E+03 | .7401E+06 | .1778E+03 | .1524E+04 |
| vinylacetate | .1938E+03 | .4530E+06 | .3024E+03 | .5398E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3110E+03 | .1185E+07 | .4847E+02 | .2440E+04 |

TOTAL MASS IN ALL PHASE = .5150E+05

TOTAL MASS IN GAS PHASE (kg) = .3012E+01
TOTAL MASS IN FREE PHASE (kg) = .5131E+05
TOTAL MASS IN WATER PHASE (kg) = .1558E+02
TOTAL MASS IN SOIL PHASE (kg) = .1738E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .3740E+06 | .2615E+00 | .3683E+01 | .2733E+04 |
| toluene | .1562E+08 | .3169E+01 | .4464E+02 | .1142E+06 |
| p-xylene | .6487E+07 | .3899E+00 | .5492E+01 | .4740E+05 |
| 111-trichloroethane | .3041E+07 | .3442E+00 | .4848E+01 | .2222E+05 |
| 1122-tetrachloroethane | .2073E+08 | .1013E+01 | .1427E+02 | .1515E+06 |
| 112-trichloroethane | .5800E+06 | .1610E+00 | .2268E+01 | .4239E+04 |
| 11-dichoroethane | .1348E+06 | .2266E+00 | .3191E+01 | .9851E+03 |
| 11-dichoroethene | .2441E+04 | .1354E-01 | .1907E+00 | .1783E+02 |
| methylenechloride | .4800E+05 | .1605E+00 | .2260E+01 | .3508E+03 |
| tetrachloroethene | .2093E+07 | .3521E-01 | .4960E+00 | .1529E+05 |
| trichloroethene | .7419E+06 | .3947E+00 | .5559E+01 | .5421E+04 |
| vinylacetate | .4535E+06 | .4772E+00 | .6721E+01 | .3314E+04 |
| vinylchloride | .2605E+02 | .0000E+00 | .0000E+00 | .1904E+00 |
| Ethylbenzene | .1188E+07 | .7656E+00 | .1078E+02 | .8683E+04 |

RESULTS AT TIME (DAYS) 5478.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1062E+03 | .3725E+06 | .2437E+03 | .1174E+04 |
| toluene | .1288E+04 | .1558E+08 | .2500E+04 | .4373E+05 |
| p-xylene | .1586E+03 | .6469E+07 | .3462E+03 | .1746E+05 |
| 111-trichloroethane | .1399E+03 | .3028E+07 | .9767E+03 | .1102E+05 |
| 1122-tetrachloroethane | .4119E+03 | .2063E+08 | .1023E+05 | .8951E+05 |
| 112-trichloroethane | .6542E+02 | .5736E+06 | .5554E+03 | .5849E+04 |
| 11-dichoroethane | .9194E+02 | .1343E+06 | .1165E+03 | .2567E+03 |
| 11-dichoroethene | .5473E+01 | .2430E+04 | .1619E+01 | .3999E+01 |
| methylenechloride | .6500E+02 | .4789E+05 | .2577E+02 | .1840E+02 |
| tetrachloroethene | .1432E+02 | .2092E+07 | .5433E+02 | .7720E+03 |
| trichloroethene | .1604E+03 | .7401E+06 | .1778E+03 | .1524E+04 |
| vinylacetate | .1938E+03 | .4530E+06 | .3024E+03 | .5398E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3110E+03 | .1185E+07 | .4847E+02 | .2440E+04 |

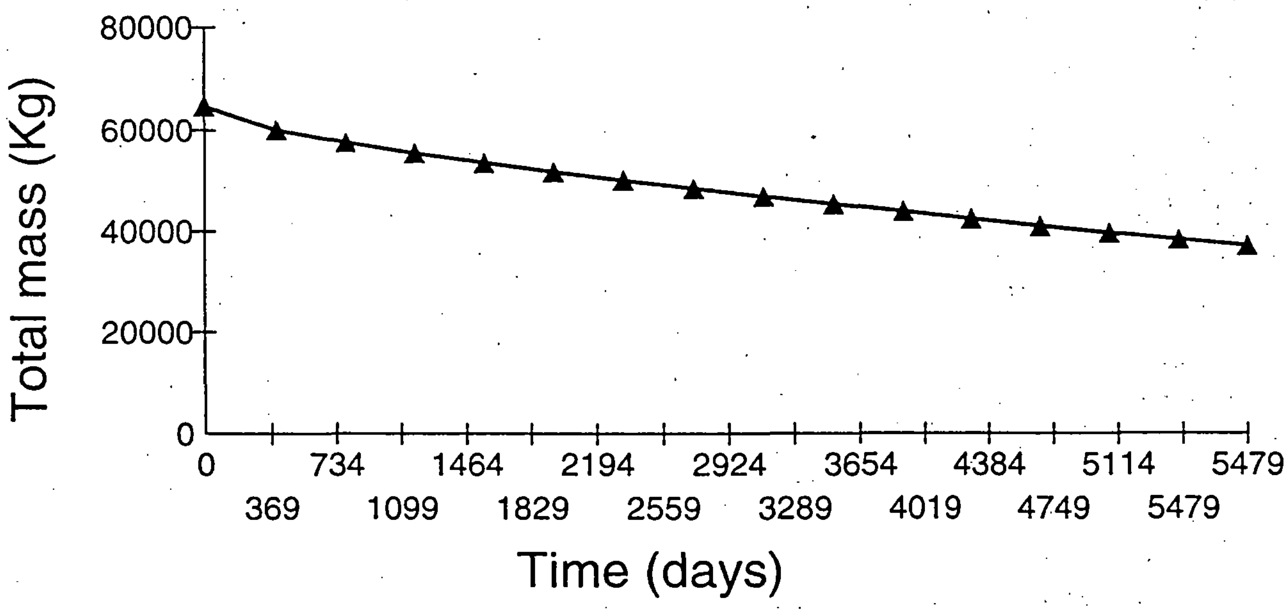
TOTAL MASS IN ALL PHASE = .5150E+05

TOTAL MASS IN GAS PHASE (kg) = .3012E+01
TOTAL MASS IN FREE PHASE (kg) = .5131E+05
TOTAL MASS IN WATER PHASE (kg) = .1558E+02
TOTAL MASS IN SOIL PHASE (kg) = .1738E+03

| SPECIES<br>S | MASS<br>g | CONC WELL GAS<br>g/m3 | CONC SOIL GAS<br>g/m3 | CONC SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .3740E+06 | .2615E+00 | .3683E+01 | .2733E+04 |
| toluene | .1562E+08 | .3169E+01 | .4464E+02 | .1142E+06 |
| p-xylene | .6487E+07 | .3899E+00 | .5492E+01 | .4740E+05 |
| 111-trichloroethane | .3041E+07 | .3442E+00 | .4848E+01 | .2222E+05 |
| 1122-tetrachloroethane | .2073E+08 | .1013E+01 | .1427E+02 | .1515E+06 |
| 112-trichloroethane | .5800E+06 | .1610E+00 | .2268E+01 | .4239E+04 |
| 11-dichoroethane | .1348E+06 | .2266E+00 | .3191E+01 | .9851E+03 |
| 11-dichoroethene | .2441E+04 | .1354E-01 | .1907E+00 | .1783E+02 |
| methylenechloride | .4800E+05 | .1605E+00 | .2260E+01 | .3508E+03 |
| tetrachloroethene | .2093E+07 | .3521E-01 | .4960E+00 | .1529E+05 |
| trichloroethene | .7419E+06 | .3947E+00 | .5559E+01 | .5421E+04 |
| vinylacetate | .4535E+06 | .4772E+00 | .6721E+01 | .3314E+04 |

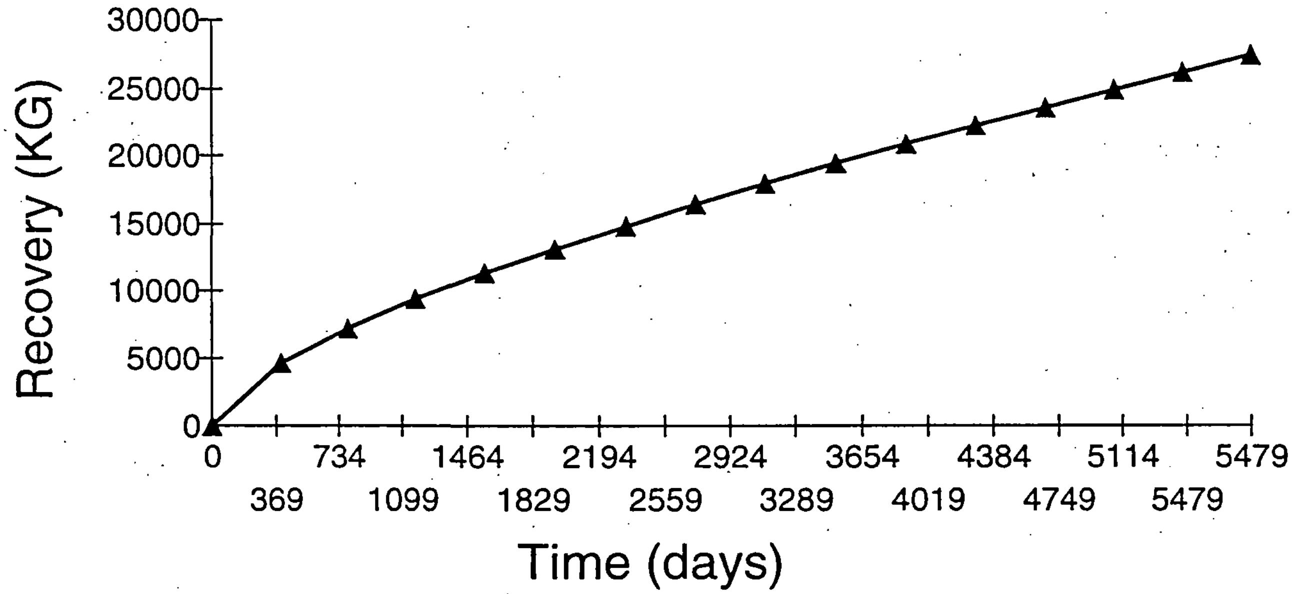
| | | | | |
|---|---|---|---|---|
| vinylchloride | .2605E+02 | .0000E+00 | .0000E+00 | .1904E+00 |
| Ethylbenzene | .1188E+07 | .7656E+00 | .1078E+02 | .8683E+04 |

# ACS Still Bottoms




5.2 darcy

# ACS Still Bottoms



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+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
+                                                               +
+                BioSVE For Window                              +
+                                                               +
+   SOIL VACUUM EXTRACTION CHEMICAL EQUILIBRIUM MODEL           +
+      BASED ON JOHNSON ET AL. (1990) GROUND WATER              +
+                                                               +
+                                                               +
+                                                               +
+                                                               +
+                    COPYRIGHT 1995                             +
+                   ASHOK KATYAL, Ph.D.                         +
+            DRAPER ADEN ENVIRONMENTAL MODELING                 +
+              BLACKSBURG, VA 24060, U.S.A.                     +
+                                                               +
+                                                               +
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
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TITLE: ACS Still Bottoms

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air flow rate   (liters/day)          = .6284E+06
total mass of contaminant (g)         = .6471E+08
maximum simulation time (days)        = .5475E+04
starting time step (days)             = .5000E+00
maximum time step  (days)             = .5000E+01
time increment factor                 =.10200E+01
printout time interval (days)         =.36500E+03
volumetric water content(fraction)    =.15000E+00
bulk density (g/cm^3)                 =.17000E+01
foc                                   =.50000E-02
contaminated soil vol. (m^3)          =.80500E+02
temperature (C)                       =.20000E+02
intercept in free prod.recov.eqn.     =.15000E+01
exponent in free prod. recov. eqn.    =.20000E-01
bio efficiency (fraction)             =.20000E-01
residual oil mass (kg)                =.64710E+04
venting efficiency (fraction)         = .7100E-01
```

| SPECIES | VAP PRES atm | BOILING POINT deg C | SOL LIMIT ppm | KOW g/g |
|---|---|---|---|---|
| benzene | .1000E+00 | .8000E+02 | .1780E+04 | .1350E+03 |
| toluene | .2900E-01 | .1110E+03 | .5150E+03 | .4900E+03 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .8600E-02 | .1380E+03 | .1980E+03 | .1413E+04 |
| 111-trichloroethane | .1620E-01 | .7410E+02 | .1500E+04 | .3160E+03 |
| 1122-tetrachloroethane | .7000E-02 | .1462E+03 | .2900E+04 | .2450E+03 |
| 112-trichloroethane | .4000E-01 | .1138E+03 | .4500E+04 | .2950E+03 |
| 11-dichoroethane | .2400E+00 | .5750E+02 | .5500E+04 | .6170E+02 |
| 11-dichoroethene | .7900E+00 | .3700E+02 | .2250E+04 | .6920E+02 |
| methylenechloride | .4760E+00 | .9370E+02 | .2000E+04 | .2000E+02 |
| tetrachloroethene | .2400E-02 | .1210E+03 | .1500E+03 | .3980E+03 |
| trichloroethene | .7600E-01 | .8720E+02 | .1100E+04 | .2400E+03 |
| vinylacetate | .1500E+00 | .7200E+02 | .2000E+04 | .5000E+00 |
| vinylchloride | .3500E+01 | .1340E+02 | .2670E+04 | .2400E+02 |
| Ethylbenzene | .9200E-01 | .1362E+03 | .1520E+03 | .1410E+04 |
| MASS FRACTION SUM | 1.000000 | | | |

| SPECIES | MOL WEIGHT g/mol | HENRY COEFF DIMENSIONLESS |
|---|---|---|
| benzene | .7810E+02 | .0000E+00 |
| toluene | .9210E+02 | .0000E+00 |
| p-xylene | .1062E+03 | .0000E+00 |
| 111-trichloroethane | .1335E+03 | .0000E+00 |
| 1122-tetrachloroethane | .1678E+03 | .0000E+00 |
| 112-trichloroethane | .1334E+03 | .0000E+00 |
| 11-dichoroethane | .1820E+03 | .0000E+00 |
| 11-dichoroethene | .9694E+02 | .0000E+00 |
| methylenechloride | .1067E+03 | .0000E+00 |
| tetrachloroethene | .1658E+03 | .0000E+00 |
| trichloroethene | .1314E+03 | .0000E+00 |
| vinylacetate | .8600E+02 | .0000E+00 |
| vinylchloride | .6250E+02 | .0000E+00 |
| Ethylbenzene | .1067E+03 | .0000E+00 |

sgmlti 556024.500000

RESULTS AT TIME (DAYS) 0.000000E+00

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1673E+03 | .7742E+06 | .3838E+03 | .1850E+04 |
| toluene | .1210E+04 | .1930E+08 | .2348E+04 | .4107E+05 |
| p-xylene | .1284E+03 | .6910E+07 | .2802E+03 | .1414E+05 |
| 111-trichloroethane | .1197E+03 | .3419E+07 | .8357E+03 | .9428E+04 |
| 1122-tetrachloroethane | .3296E+03 | .2179E+08 | .8191E+04 | .7164E+05 |
| 112-trichloroethane | .6655E+02 | .7700E+06 | .5650E+03 | .5950E+04 |
| 11-dichoroethane | .4017E+03 | .7745E+06 | .5091E+03 | .1121E+04 |

| | | | | |
|---|---|---|---|---|
| 11-dichoroethene | .1321E+04 | .7739E+06 | .3907E+03 | .9652E+03 |
| methylenechloride | .1595E+04 | .1550E+07 | .6322E+03 | .4514E+03 |
| tetrachloroethene | .1107E+02 | .2135E+07 | .4201E+02 | .5969E+03 |
| trichloroethene | .2122E+03 | .1292E+07 | .2352E+03 | .2015E+04 |
| vinylacetate | .4401E+03 | .1358E+07 | .6869E+03 | .1226E+02 |
| vinylchloride | .1014E+05 | .1341E+07 | .4360E+04 | .3736E+04 |
| Ethylbenzene | .4623E+03 | .2326E+07 | .7206E+02 | .3627E+04 |

TOTAL MASS IN ALL PHASE = .6471E+05

TOTAL MASS IN GAS PHASE (kg) = .1660E+02
TOTAL MASS IN FREE PHASE (kg) = .6452E+05
TOTAL MASS IN WATER PHASE (kg) = .1953E+02
TOTAL MASS IN SOIL PHASE (kg) = .1566E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| <br>g | g | g/m3 | g/m3 | mg/k |
| benzene | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| toluene | .1935E+08 | .0000E+00 | .0000E+00 | .1414E+06 |
| p-xylene | .6924E+07 | .0000E+00 | .0000E+00 | .5060E+05 |
| 111-trichloroethane | .3430E+07 | .0000E+00 | .0000E+00 | .2506E+05 |
| 1122-tetrachloroethane | .2187E+08 | .0000E+00 | .0000E+00 | .1598E+06 |
| 112-trichloroethane | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| 11-dichoroethane | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| 11-dichoroethene | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| methylenechloride | .1553E+07 | .0000E+00 | .0000E+00 | .1135E+05 |
| tetrachloroethene | .2136E+07 | .0000E+00 | .0000E+00 | .1561E+05 |
| trichloroethene | .1294E+07 | .0000E+00 | .0000E+00 | .9458E+04 |
| vinylacetate | .1359E+07 | .0000E+00 | .0000E+00 | .9931E+04 |
| vinylchloride | .1359E+07 | .3885E-03 | .5472E-02 | .9931E+04 |
| Ethylbenzene | .2330E+07 | .0000E+00 | .0000E+00 | .1702E+05 |

end of initial conditions

RESULTS AT TIME (DAYS) 368.606000

| SPECIES | ........MASS (g) IN PHASES ....<br>GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1621E+03 | .6788E+06 | .3718E+03 | .1792E+04 |
| toluene | .1286E+04 | .1857E+08 | .2496E+04 | .4367E+05 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .1402E+03 | .6828E+07 | .3060E+03 | .1543E+05 |
| 111-trichloroethane | .1294E+03 | .3345E+07 | .9034E+03 | .1019E+05 |
| 1122-tetrachloroethane | .3606E+03 | .2158E+08 | .8961E+04 | .7838E+05 |
| 112-trichloroethane | .6972E+02 | .7300E+06 | .5919E+03 | .6233E+04 |
| 11-dichoroethane | .3240E+03 | .5654E+06 | .4107E+03 | .9045E+03 |
| 11-dichoroethene | .5174E+03 | .2743E+06 | .1530E+03 | .3780E+03 |
| methylenechloride | .9432E+03 | .8299E+06 | .3739E+03 | .2669E+03 |
| tetrachloroethene | .1219E+02 | .2127E+07 | .4625E+02 | .6572E+03 |
| trichloroethene | .2121E+03 | .1169E+07 | .2352E+03 | .2015E+04 |
| vinylacetate | .3993E+03 | .1115E+07 | .6232E+03 | .1112E+02 |
| vinylchloride | .1098E+03 | .1314E+05 | .4723E+02 | .4047E+02 |
| Ethylbenzene | .4526E+03 | .2061E+07 | .7055E+02 | .3551E+04 |

TOTAL MASS IN ALL PHASE = .6007E+05

TOTAL MASS IN GAS PHASE (kg) = .5119E+01
TOTAL MASS IN FREE PHASE (kg) = .5989E+05
TOTAL MASS IN WATER PHASE (kg) = .1559E+02
TOTAL MASS IN SOIL PHASE (kg) = .1635E+03

| SPECIES S | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k g |
| benzene | .6811E+06 | .3992E+00 | .5622E+01 | .4977E+04 |
| toluene | .1862E+08 | .3163E+01 | .4456E+02 | .1361E+06 |
| p-xylene | .6844E+07 | .3447E+00 | .4855E+01 | .5001E+05 |
| 111-trichloroethane | .3357E+07 | .3182E+00 | .4481E+01 | .2453E+05 |
| 1122-tetrachloroethane | .2166E+08 | .8868E+00 | .1249E+02 | .1583E+06 |
| 112-trichloroethane | .7369E+06 | .1715E+00 | .2416E+01 | .5385E+04 |
| 11-dichoroethane | .5670E+06 | .8000E+00 | .1127E+02 | .4144E+04 |
| 11-dichoroethene | .2753E+06 | .1291E+01 | .1818E+02 | .2012E+04 |
| methylenechloride | .8315E+06 | .2339E+01 | .3295E+02 | .6076E+04 |
| tetrachloroethene | .2128E+07 | .2994E-01 | .4217E+00 | .1555E+05 |
| trichloroethene | .1171E+07 | .5221E+00 | .7354E+01 | .8559E+04 |
| vinylacetate | .1116E+07 | .9844E+00 | .1386E+02 | .8155E+04 |
| vinylchloride | .1335E+05 | .2883E+00 | .4061E+01 | .9759E+02 |
| Ethylbenzene | .2065E+07 | .1115E+01 | .1570E+02 | .1509E+05 |

RESULTS AT TIME (DAYS) 733.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |

| | | | | |
|---|---|---|---|---|
| benzene | .1484E+03 | .5910E+06 | .3405E+03 | .1641E+04 |
| toluene | .1299E+04 | .1783E+08 | .2521E+04 | .4410E+05 |
| p-xylene | .1456E+03 | .6743E+07 | .3178E+03 | .1603E+05 |
| 111-trichloroethane | .1330E+03 | .3269E+07 | .9286E+03 | .1048E+05 |
| 1122-tetrachloroethane | .3754E+03 | .2136E+08 | .9328E+04 | .8159E+05 |
| 112-trichloroethane | .6935E+02 | .6904E+06 | .5888E+03 | .6200E+04 |
| 11-dichoroethane | .2444E+03 | .4056E+06 | .3098E+03 | .6825E+03 |
| 11-dichoroethene | .1817E+03 | .9160E+05 | .5374E+02 | .1328E+03 |
| methylenechloride | .5125E+03 | .4288E+06 | .2032E+03 | .1451E+03 |
| tetrachloroethene | .1277E+02 | .2119E+07 | .4846E+02 | .6886E+03 |
| trichloroethene | .2007E+03 | .1052E+07 | .2226E+03 | .1907E+04 |
| vinylacetate | .3411E+03 | .9056E+06 | .5324E+03 | .9503E+01 |
| vinylchloride | .8397E+00 | .9554E+02 | .3611E+00 | .3094E+00 |
| Ethylbenzene | .4190E+03 | .1814E+07 | .6531E+02 | .3287E+04 |

TOTAL MASS IN ALL PHASE = .5749E+05

TOTAL MASS IN GAS PHASE (kg) = .4084E+01
TOTAL MASS IN FREE PHASE (kg) = .5730E+05
TOTAL MASS IN WATER PHASE (kg) = .1546E+02
TOTAL MASS IN SOIL PHASE (kg) = .1669E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .5931E+06 | .3656E+00 | .5149E+01 | .4334E+04 |
| toluene | .1788E+08 | .3195E+01 | .4500E+02 | .1307E+06 |
| p-xylene | .6760E+07 | .3581E+00 | .5043E+01 | .4940E+05 |
| 111-trichloroethane | .3281E+07 | .3271E+00 | .4608E+01 | .2397E+05 |
| 1122-tetrachloroethane | .2145E+08 | .9231E+00 | .1300E+02 | .1567E+06 |
| 112-trichloroethane | .6973E+06 | .1707E+00 | .2404E+01 | .5095E+04 |
| 11-dichoroethane | .4068E+06 | .6038E+00 | .8504E+01 | .2973E+04 |
| 11-dichoroethene | .9197E+05 | .4537E+00 | .6390E+01 | .6721E+03 |
| methylenechloride | .4297E+06 | .1272E+01 | .1791E+02 | .3140E+04 |
| tetrachloroethene | .2120E+07 | .3143E-01 | .4427E+00 | .1549E+05 |
| trichloroethene | .1054E+07 | .4943E+00 | .6962E+01 | .7703E+04 |
| vinylacetate | .9065E+06 | .8412E+00 | .1185E+02 | .6624E+04 |
| vinylchloride | .9716E+02 | .2212E-02 | .3116E-01 | .7100E+00 |
| Ethylbenzene | .1817E+07 | .1032E+01 | .1454E+02 | .1328E+05 |

RESULTS AT TIME (DAYS) 1098.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1341E+03 | .5111E+06 | .3078E+03 | .1483E+04 |
| toluene | .1301E+04 | .1709E+08 | .2525E+04 | .4417E+05 |
| p-xylene | .1502E+03 | .6656E+07 | .3278E+03 | .1654E+05 |
| 111-trichloroethane | .1357E+03 | .3192E+07 | .9474E+03 | .1069E+05 |
| 1122-tetrachloroethane | .3881E+03 | .2113E+08 | .9644E+04 | .8435E+05 |
| 112-trichloroethane | .6837E+02 | .6513E+06 | .5804E+03 | .6113E+04 |
| 11-dichoroethane | .1804E+03 | .2864E+06 | .2286E+03 | .5036E+03 |
| 11-dichoroethene | .6016E+02 | .2902E+05 | .1779E+02 | .4396E+02 |
| methylenechloride | .2681E+03 | .2146E+06 | .1063E+03 | .7588E+02 |
| tetrachloroethene | .1329E+02 | .2111E+07 | .5045E+02 | .7168E+03 |
| trichloroethene | .1878E+03 | .9417E+06 | .2083E+03 | .1784E+04 |
| vinylacetate | .2867E+03 | .7282E+06 | .4474E+03 | .7986E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3831E+03 | .1587E+07 | .5971E+02 | .3006E+04 |

TOTAL MASS IN ALL PHASE = .5531E+05

TOTAL MASS IN GAS PHASE (kg) = .3557E+01
TOTAL MASS IN FREE PHASE (kg) = .5513E+05
TOTAL MASS IN WATER PHASE (kg) = .1545E+02
TOTAL MASS IN SOIL PHASE (kg) = .1695E+03

| SPECIES S | MASS g | CONC WELL GAS g/m3 | CONC SOIL GAS g/m3 | CONC SOIL MAS mg/k g |
|---|---|---|---|---|
| benzene | .5131E+06 | .3305E+00 | .4655E+01 | .3749E+04 |
| toluene | .1714E+08 | .3201E+01 | .4508E+02 | .1252E+06 |
| p-xylene | .6673E+07 | .3696E+00 | .5205E+01 | .4876E+05 |
| 111-trichloroethane | .3203E+07 | .3338E+00 | .4701E+01 | .2341E+05 |
| 1122-tetrachloroethane | .2122E+08 | .9544E+00 | .1344E+02 | .1551E+06 |
| 112-trichloroethane | .6581E+06 | .1683E+00 | .2370E+01 | .4809E+04 |
| 11-dichoroethane | .2873E+06 | .4457E+00 | .6277E+01 | .2099E+04 |
| 11-dichoroethene | .2914E+05 | .1503E+00 | .2117E+01 | .2129E+03 |
| methylenechloride | .2151E+06 | .6657E+00 | .9376E+01 | .1572E+04 |
| tetrachloroethene | .2111E+07 | .3272E-01 | .4609E+00 | .1543E+05 |
| trichloroethene | .9439E+06 | .4626E+00 | .6515E+01 | .6897E+04 |
| vinylacetate | .7290E+06 | .7071E+00 | .9959E+01 | .5327E+04 |
| vinylchloride | .2775E+02 | .0000E+00 | .0000E+00 | .2028E+00 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .1590E+07 | .9437E+00 | .1329E+02 | .1162E+05 |

RESULTS AT TIME (DAYS) 1463.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1201E+03 | .4393E+06 | .2756E+03 | .1328E+04 |
| toluene | .1296E+04 | .1635E+08 | .2516E+04 | .4402E+05 |
| p-xylene | .1544E+03 | .6566E+07 | .3370E+03 | .1700E+05 |
| 111-trichloroethane | .1379E+03 | .3113E+07 | .9626E+03 | .1086E+05 |
| 1122-tetrachloroethane | .3998E+03 | .2089E+08 | .9936E+04 | .8690E+05 |
| 112-trichloroethane | .6703E+02 | .6129E+06 | .5691E+03 | .5993E+04 |
| 11-dichoroethane | .1307E+03 | .1992E+06 | .1657E+03 | .3649E+03 |
| 11-dichoroethene | .1889E+02 | .8744E+04 | .5586E+01 | .1380E+02 |
| methylenechloride | .1357E+03 | .1042E+06 | .5378E+02 | .3840E+02 |
| tetrachloroethene | .1379E+02 | .2102E+07 | .5234E+02 | .7437E+03 |
| trichloroethene | .1744E+03 | .8392E+06 | .1934E+03 | .1657E+04 |
| vinylacetate | .2379E+03 | .5801E+06 | .3713E+03 | .6628E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3472E+03 | .1380E+07 | .5411E+02 | .2724E+04 |

TOTAL MASS IN ALL PHASE = .5338E+05

TOTAL MASS IN GAS PHASE (kg) = .3234E+01
TOTAL MASS IN FREE PHASE (kg) = .5319E+05
TOTAL MASS IN WATER PHASE (kg) = .1549E+02
TOTAL MASS IN SOIL PHASE (kg) = .1716E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .4410E+06 | .2960E+00 | .4169E+01 | .3223E+04 |
| toluene | .1640E+08 | .3190E+01 | .4493E+02 | .1198E+06 |
| p-xylene | .6584E+07 | .3797E+00 | .5348E+01 | .4811E+05 |
| 111-trichloroethane | .3125E+07 | .3391E+00 | .4776E+01 | .2283E+05 |
| 1122-tetrachloroethane | .2099E+08 | .9832E+00 | .1385E+02 | .1534E+06 |
| 112-trichloroethane | .6195E+06 | .1650E+00 | .2324E+01 | .4527E+04 |
| 11-dichoroethane | .1998E+06 | .3230E+00 | .4549E+01 | .1460E+04 |
| 11-dichoroethene | .8783E+04 | .4723E-01 | .6652E+00 | .6418E+02 |
| methylenechloride | .1045E+06 | .3370E+00 | .4747E+01 | .7634E+03 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .2103E+07 | .3391E-01 | .4776E+00 | .1537E+05 |
| trichloroethene | .8412E+06 | .4295E+00 | .6049E+01 | .6147E+04 |
| vinylacetate | .5807E+06 | .5869E+00 | .8266E+01 | .4243E+04 |
| vinylchloride | .2570E+02 | .0000E+00 | .0000E+00 | .1878E+00 |
| Ethylbenzene | .1383E+07 | .8553E+00 | .1205E+02 | .1011E+05 |

RESULTS AT TIME (DAYS) 1828.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1067E+03 | .3753E+06 | .2449E+03 | .1180E+04 |
| toluene | .1288E+04 | .1561E+08 | .2499E+04 | .4372E+05 |
| p-xylene | .1583E+03 | .6474E+07 | .3456E+03 | .1743E+05 |
| 111-trichloroethane | .1397E+03 | .3033E+07 | .9755E+03 | .1100E+05 |
| 1122-tetrachloroethane | .4111E+03 | .2065E+08 | .1021E+05 | .8934E+05 |
| 112-trichloroethane | .6545E+02 | .5753E+06 | .5556E+03 | .5852E+04 |
| 11-dichoroethane | .9315E+02 | .1365E+06 | .1181E+03 | .2601E+03 |
| 11-dichoroethene | .5636E+01 | .2508E+04 | .1667E+01 | .4118E+01 |
| methylenechloride | .6654E+02 | .4916E+05 | .2638E+02 | .1883E+02 |
| tetrachloroethene | .1429E+02 | .2093E+07 | .5421E+02 | .7702E+03 |
| trichloroethene | .1609E+03 | .7443E+06 | .1784E+03 | .1528E+04 |
| vinylacetate | .1953E+03 | .4578E+06 | .3048E+03 | .5441E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3123E+03 | .1194E+07 | .4868E+02 | .2450E+04 |

TOTAL MASS IN ALL PHASE = .5159E+05

TOTAL MASS IN GAS PHASE (kg) = .3017E+01
TOTAL MASS IN FREE PHASE (kg) = .5139E+05
TOTAL MASS IN WATER PHASE (kg) = .1557E+02
TOTAL MASS IN SOIL PHASE (kg) = .1736E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .3768E+06 | .2630E+00 | .3704E+01 | .2753E+04 |
| toluene | .1566E+08 | .3169E+01 | .4463E+02 | .1144E+06 |
| p-xylene | .6492E+07 | .3895E+00 | .5486E+01 | .4744E+05 |
| 111-trichloroethane | .3045E+07 | .3437E+00 | .4841E+01 | .2225E+05 |
| 1122-tetrachloroethane | .2075E+08 | .1011E+01 | .1424E+02 | .1516E+06 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .5818E+06 | .1611E+00 | .2269E+01 | .4252E+04 |
| 11-dichoroethane | .1369E+06 | .2303E+00 | .3243E+01 | .1001E+04 |
| 11-dichoroethene | .2520E+04 | .1410E-01 | .1986E+00 | .1842E+02 |
| methylenechloride | .4927E+05 | .1654E+00 | .2329E+01 | .3600E+03 |
| tetrachloroethene | .2094E+07 | .3515E-01 | .4950E+00 | .1530E+05 |
| trichloroethene | .7461E+06 | .3962E+00 | .5581E+01 | .5452E+04 |
| vinylacetate | .4583E+06 | .4818E+00 | .6787E+01 | .3349E+04 |
| vinylchloride | .2569E+02 | .0000E+00 | .0000E+00 | .1877E+00 |
| Ethylbenzene | .1196E+07 | .7695E+00 | .1084E+02 | .8742E+04 |

RESULTS AT TIME (DAYS) 2193.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .9415E+02 | .3186E+06 | .2160E+03 | .1041E+04 |
| toluene | .1275E+04 | .1488E+08 | .2476E+04 | .4331E+05 |
| p-xylene | .1622E+03 | .6380E+07 | .3539E+03 | .1785E+05 |
| 111-trichloroethane | .1413E+03 | .2951E+07 | .9866E+03 | .1113E+05 |
| 1122-tetrachloroethane | .4220E+03 | .2040E+08 | .1049E+05 | .9172E+05 |
| 112-trichloroethane | .6369E+02 | .5388E+06 | .5407E+03 | .5694E+04 |
| 11-dichoroethane | .6535E+02 | .9213E+05 | .8283E+02 | .1824E+03 |
| 11-dichoroethene | .1599E+01 | .6847E+03 | .4728E+00 | .1168E+01 |
| methylenechloride | .3165E+02 | .2250E+05 | .1255E+02 | .8957E+01 |
| tetrachloroethene | .1478E+02 | .2084E+07 | .5608E+02 | .7968E+03 |
| trichloroethene | .1476E+03 | .6570E+06 | .1636E+03 | .1402E+04 |
| vinylacetate | .1587E+03 | .3579E+06 | .2476E+03 | .4421E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2791E+03 | .1026E+07 | .4350E+02 | .2189E+04 |

TOTAL MASS IN ALL PHASE = .4990E+05

TOTAL MASS IN GAS PHASE (kg) = .2857E+01
TOTAL MASS IN FREE PHASE (kg) = .4971E+05
TOTAL MASS IN WATER PHASE (kg) = .1567E+02
TOTAL MASS IN SOIL PHASE (kg) = .1753E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .3199E+06 | .2321E+00 | .3268E+01 | .2338E+04 |

| | | | | |
|---|---|---|---|---|
| toluene | .1493E+08 | .3138E+01 | .4420E+02 | .1091E+06 |
| p-xylene | .6398E+07 | .3987E+00 | .5616E+01 | .4675E+05 |
| 111-trichloroethane | .2964E+07 | .3476E+00 | .4896E+01 | .2166E+05 |
| 1122-tetrachloroethane | .2050E+08 | .1038E+01 | .1462E+02 | .1498E+06 |
| 112-trichloroethane | .5451E+06 | .1568E+00 | .2208E+01 | .3983E+04 |
| 11-dichoroethane | .9246E+05 | .1616E+00 | .2276E+01 | .6756E+03 |
| 11-dichoroethene | .6880E+03 | .4003E-02 | .5638E-01 | .5028E+01 |
| methylenechloride | .2255E+05 | .7868E-01 | .1108E+01 | .1648E+03 |
| tetrachloroethene | .2084E+07 | .3633E-01 | .5117E+00 | .1523E+05 |
| trichloroethene | .6587E+06 | .3635E+00 | .5119E+01 | .4813E+04 |
| vinylacetate | .3584E+06 | .3915E+00 | .5515E+01 | .2619E+04 |
| vinylchloride | .2365E+02 | .0000E+00 | .0000E+00 | .1728E+00 |
| Ethylbenzene | .1029E+07 | .6876E+00 | .9685E+01 | .7518E+04 |

RESULTS AT TIME (DAYS) 2558.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .8249E+02 | .2687E+06 | .1893E+03 | .9121E+03 |
| toluene | .1260E+04 | .1416E+08 | .2446E+04 | .4279E+05 |
| p-xylene | .1659E+03 | .6283E+07 | .3620E+03 | .1826E+05 |
| 111-trichloroethane | .1427E+03 | .2870E+07 | .9963E+03 | .1124E+05 |
| 1122-tetrachloroethane | .4329E+03 | .2014E+08 | .1076E+05 | .9408E+05 |
| 112-trichloroethane | .6179E+02 | .5032E+06 | .5246E+03 | .5524E+04 |
| 11-dichoroethane | .4513E+02 | .6125E+05 | .5720E+02 | .1260E+03 |
| 11-dichoroethene | .4309E+00 | .1777E+03 | .1274E+00 | .3148E+00 |
| methylenechloride | .1459E+02 | .9987E+04 | .5784E+01 | .4130E+01 |
| tetrachloroethene | .1528E+02 | .2074E+07 | .5798E+02 | .8238E+03 |
| trichloroethene | .1346E+03 | .5771E+06 | .1493E+03 | .1279E+04 |
| vinylacetate | .1276E+03 | .2772E+06 | .1992E+03 | .3556E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2478E+03 | .8774E+06 | .3862E+02 | .1944E+04 |

TOTAL MASS IN ALL PHASE = .4830E+05

TOTAL MASS IN GAS PHASE (kg) = .2732E+01
TOTAL MASS IN FREE PHASE (kg) = .4810E+05
TOTAL MASS IN WATER PHASE (kg) = .1578E+02
TOTAL MASS IN SOIL PHASE (kg) = .1770E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|

S

| | g | g/m3 | g/m3 | mg/k g |
|---|---|---|---|---|
| benzene | .2699E+06 | .2033E+00 | .2864E+01 | .1972E+04 |
| toluene | .1420E+08 | .3101E+01 | .4368E+02 | .1038E+06 |
| p-xylene | .6302E+07 | .4080E+00 | .5746E+01 | .4605E+05 |
| 111-trichloroethane | .2882E+07 | .3510E+00 | .4944E+01 | .2106E+05 |
| 1122-tetrachloroethane | .2025E+08 | .1065E+01 | .1499E+02 | .1480E+06 |
| 112-trichloroethane | .5093E+06 | .1521E+00 | .2142E+01 | .3722E+04 |
| 11-dichoroethane | .6148E+05 | .1116E+00 | .1572E+01 | .4492E+03 |
| 11-dichoroethene | .1786E+03 | .1080E-02 | .1521E-01 | .1305E+01 |
| methylenechloride | .1001E+05 | .3629E-01 | .5112E+00 | .7316E+02 |
| tetrachloroethene | .2075E+07 | .3757E-01 | .5291E+00 | .1516E+05 |
| trichloroethene | .5787E+06 | .3317E+00 | .4672E+01 | .4229E+04 |
| vinylacetate | .2775E+06 | .3150E+00 | .4436E+01 | .2028E+04 |
| vinylchloride | .2364E+02 | .0000E+00 | .0000E+00 | .1727E+00 |
| Ethylbenzene | .8796E+06 | .6107E+00 | .8601E+01 | .6428E+04 |

RESULTS AT TIME (DAYS) 2923.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .7179E+02 | .2252E+06 | .1647E+03 | .7938E+03 |
| toluene | .1243E+04 | .1344E+08 | .2412E+04 | .4220E+05 |
| p-xylene | .1695E+03 | .6184E+07 | .3700E+03 | .1866E+05 |
| 111-trichloroethane | .1439E+03 | .2787E+07 | .1005E+04 | .1134E+05 |
| 1122-tetrachloroethane | .4437E+03 | .1988E+08 | .1102E+05 | .9642E+05 |
| 112-trichloroethane | .5978E+02 | .4688E+06 | .5075E+03 | .5345E+04 |
| 11-dichoroethane | .3067E+02 | .4009E+05 | .3887E+02 | .8562E+02 |
| 11-dichoroethene | .1102E+00 | .4375E+02 | .3259E-01 | .8050E-01 |
| methylenechloride | .6519E+01 | .4296E+04 | .2584E+01 | .1845E+01 |
| tetrachloroethene | .1579E+02 | .2064E+07 | .5991E+02 | .8513E+03 |
| trichloroethene | .1222E+03 | .5044E+06 | .1355E+03 | .1161E+04 |
| vinylacetate | .1016E+03 | .2125E+06 | .1586E+03 | .2831E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2187E+03 | .7456E+06 | .3408E+02 | .1716E+04 |

TOTAL MASS IN ALL PHASE = .4676E+05

TOTAL MASS IN GAS PHASE (kg) = .2627E+01
TOTAL MASS IN FREE PHASE (kg) = .4656E+05
TOTAL MASS IN WATER PHASE (kg) = .1591E+02
TOTAL MASS IN SOIL PHASE (kg) = .1786E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .2262E+06 | .1770E+00 | .2492E+01 | .1653E+04 |
| toluene | .1349E+08 | .3059E+01 | .4308E+02 | .9857E+05 |
| p-xylene | .6204E+07 | .4170E+00 | .5873E+01 | .4533E+05 |
| 111-trichloroethane | .2799E+07 | .3541E+00 | .4987E+01 | .2046E+05 |
| 1122-tetrachloroethane | .1999E+08 | .1091E+01 | .1536E+02 | .1461E+06 |
| 112-trichloroethane | .4747E+06 | .1471E+00 | .2072E+01 | .3469E+04 |
| 11-dichoroethane | .4024E+05 | .7586E-01 | .1068E+01 | .2941E+03 |
| 11-dichoroethene | .4398E+02 | .2763E-03 | .3891E-02 | .3214E+00 |
| methylenechloride | .4307E+04 | .1622E-01 | .2284E+00 | .3147E+02 |
| tetrachloroethene | .2065E+07 | .3886E-01 | .5473E+00 | .1509E+05 |
| trichloroethene | .5059E+06 | .3011E+00 | .4241E+01 | .3696E+04 |
| vinylacetate | .2128E+06 | .2508E+00 | .3533E+01 | .1555E+04 |
| vinylchloride | .2159E+02 | .0000E+00 | .0000E+00 | .1578E+00 |
| Ethylbenzene | .7475E+06 | .5389E+00 | .7590E+01 | .5462E+04 |

RESULTS AT TIME (DAYS) 3288.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .6205E+02 | .1875E+06 | .1424E+03 | .6861E+03 |
| toluene | .1223E+04 | .1274E+08 | .2374E+04 | .4152E+05 |
| p-xylene | .1732E+03 | .6084E+07 | .3779E+03 | .1906E+05 |
| 111-trichloroethane | .1450E+03 | .2704E+07 | .1012E+04 | .1142E+05 |
| 1122-tetrachloroethane | .4545E+03 | .1961E+08 | .1129E+05 | .9877E+05 |
| 112-trichloroethane | .5767E+02 | .4356E+06 | .4896E+03 | .5156E+04 |
| 11-dichoroethane | .2051E+02 | .2581E+05 | .2599E+02 | .5725E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .2819E+01 | .1789E+04 | .1117E+01 | .7978E+00 |
| tetrachloroethene | .1631E+02 | .2054E+07 | .6190E+02 | .8795E+03 |
| trichloroethene | .1103E+03 | .4387E+06 | .1224E+03 | .1048E+04 |
| vinylacetate | .8010E+02 | .1613E+06 | .1250E+03 | .2231E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1917E+03 | .6296E+06 | .2988E+02 | .1504E+04 |

TOTAL MASS IN ALL PHASE = .4527E+05

TOTAL MASS IN GAS PHASE (kg) = .2537E+01
TOTAL MASS IN FREE PHASE (kg) = .4508E+05
TOTAL MASS IN WATER PHASE (kg) = .1605E+02

TOTAL MASS IN SOIL PHASE (kg) = .1801E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .1884E+06 | .1530E+00 | .2155E+01 | .1376E+04 |
| toluene | .1279E+08 | .3010E+01 | .4239E+02 | .9343E+05 |
| p-xylene | .6103E+07 | .4259E+00 | .5999E+01 | .4460E+05 |
| 111-trichloroethane | .2716E+07 | .3566E+00 | .5022E+01 | .1985E+05 |
| 1122-tetrachloroethane | .1972E+08 | .1118E+01 | .1574E+02 | .1441E+06 |
| 112-trichloroethane | .4413E+06 | .1420E+00 | .2000E+01 | .3225E+04 |
| 11-dichoroethane | .2592E+05 | .5073E-01 | .7146E+00 | .1894E+03 |
| 11-dichoroethene | .3471E+02 | .0000E+00 | .0000E+00 | .2536E+00 |
| methylenechloride | .1794E+04 | .7017E-02 | .9883E-01 | .1311E+02 |
| tetrachloroethene | .2054E+07 | .4014E-01 | .5654E+00 | .1501E+05 |
| trichloroethene | .4399E+06 | .2719E+00 | .3829E+01 | .3215E+04 |
| vinylacetate | .1615E+06 | .1977E+00 | .2785E+01 | .1180E+04 |
| vinylchloride | .2158E+02 | .0000E+00 | .0000E+00 | .1577E+00 |
| Ethylbenzene | .6313E+06 | .4726E+00 | .6656E+01 | .4613E+04 |

RESULTS AT TIME (DAYS) 3653.606000

| SPECIES | ........MASS (g) IN PHASES ..... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .5326E+02 | .1550E+06 | .1222E+03 | .5889E+03 |
| toluene | .1201E+04 | .1205E+08 | .2331E+04 | .4078E+05 |
| p-xylene | .1768E+03 | .5981E+07 | .3858E+03 | .1946E+05 |
| 111-trichloroethane | .1459E+03 | .2620E+07 | .1018E+04 | .1149E+05 |
| 1122-tetrachloroethane | .4653E+03 | .1934E+08 | .1156E+05 | .1011E+06 |
| 112-trichloroethane | .5549E+02 | .4036E+06 | .4711E+03 | .4961E+04 |
| 11-dichoroethane | .1348E+02 | .1634E+05 | .1709E+02 | .3764E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .1179E+01 | .7204E+03 | .4672E+00 | .3336E+00 |
| tetrachloroethene | .1685E+02 | .2043E+07 | .6394E+02 | .9086E+03 |
| trichloroethene | .9911E+02 | .3794E+06 | .1099E+03 | .9416E+03 |
| vinylacetate | .6246E+02 | .1212E+06 | .9749E+02 | .1740E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1670E+03 | .5282E+06 | .2604E+02 | .1311E+04 |

TOTAL MASS IN ALL PHASE = .4384E+05

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TOTAL MASS IN GAS PHASE (kg)      = .2458E+01
TOTAL MASS IN FREE PHASE (kg)     = .4364E+05
TOTAL MASS IN WATER PHASE (kg)    = .1621E+02
TOTAL MASS IN SOIL PHASE (kg)     = .1816E+03
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| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .1557E+06 | .1313E+00 | .1849E+01 | .1138E+04 |
| toluene | .1209E+08 | .2956E+01 | .4163E+02 | .8837E+05 |
| p-xylene | .6001E+07 | .4348E+00 | .6124E+01 | .4385E+05 |
| 111-trichloroethane | .2632E+07 | .3588E+00 | .5054E+01 | .1924E+05 |
| 1122-tetrachloroethane | .1945E+08 | .1145E+01 | .1612E+02 | .1421E+06 |
| 112-trichloroethane | .4091E+06 | .1366E+00 | .1924E+01 | .2989E+04 |
| 11-dichoroethane | .1641E+05 | .3336E-01 | .4699E+00 | .1199E+03 |
| 11-dichoroethene | .3327E+02 | .0000E+00 | .0000E+00 | .2431E+00 |
| methylenechloride | .7224E+03 | .2935E-02 | .4134E-01 | .5279E+01 |
| tetrachloroethene | .2044E+07 | .4143E-01 | .5836E+00 | .1493E+05 |
| trichloroethene | .3806E+06 | .2442E+00 | .3440E+01 | .2781E+04 |
| vinylacetate | .1213E+06 | .1542E+00 | .2172E+01 | .8865E+03 |
| vinylchloride | .2157E+02 | .0000E+00 | .0000E+00 | .1576E+00 |
| Ethylbenzene | .5297E+06 | .4117E+00 | .5799E+01 | .3871E+04 |

RESULTS AT TIME (DAYS) 4018.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .4539E+02 | .1272E+06 | .1041E+03 | .5018E+03 |
| toluene | .1177E+04 | .1137E+08 | .2285E+04 | .3997E+05 |
| p-xylene | .1804E+03 | .5876E+07 | .3936E+03 | .1986E+05 |
| 111-trichloroethane | .1466E+03 | .2536E+07 | .1024E+04 | .1155E+05 |
| 1122-tetrachloroethane | .4762E+03 | .1906E+08 | .1183E+05 | .1035E+06 |
| 112-trichloroethane | .5324E+02 | .3729E+06 | .4520E+03 | .4760E+04 |
| 11-dichoroethane | .8711E+01 | .1017E+05 | .1104E+02 | .2432E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .4758E+00 | .2800E+03 | .1886E+00 | .1347E+00 |
| tetrachloroethene | .1741E+02 | .2032E+07 | .6605E+02 | .9385E+03 |
| trichloroethene | .8854E+02 | .3264E+06 | .9817E+02 | .8411E+03 |
| vinylacetate | .4819E+02 | .9000E+05 | .7520E+02 | .1342E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .1446E+03 | .4402E+06 | .2253E+02 | .1134E+04 |

TOTAL MASS IN ALL PHASE = .4244E+05

TOTAL MASS IN GAS PHASE (kg) = .2387E+01
TOTAL MASS IN FREE PHASE (kg) = .4224E+05
TOTAL MASS IN WATER PHASE (kg) = .1636E+02
TOTAL MASS IN SOIL PHASE (kg) = .1831E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .1278E+06 | .1119E+00 | .1576E+01 | .9339E+03 |
| toluene | .1141E+08 | .2897E+01 | .4080E+02 | .8341E+05 |
| p-xylene | .5896E+07 | .4436E+00 | .6248E+01 | .4308E+05 |
| 111-trichloroethane | .2548E+07 | .3607E+00 | .5080E+01 | .1862E+05 |
| 1122-tetrachloroethane | .1918E+08 | .1171E+01 | .1649E+02 | .1401E+06 |
| 112-trichloroethane | .3782E+06 | .1311E+00 | .1846E+01 | .2763E+04 |
| 11-dichoroethane | .1021E+05 | .2156E-01 | .3037E+00 | .7462E+02 |
| 11-dichoroethene | .3254E+02 | .0000E+00 | .0000E+00 | .2378E+00 |
| methylenechloride | .2809E+03 | .1186E-02 | .1670E-01 | .2052E+01 |
| tetrachloroethene | .2033E+07 | .4282E-01 | .6031E+00 | .1485E+05 |
| trichloroethene | .3274E+06 | .2182E+00 | .3073E+01 | .2392E+04 |
| vinylacetate | .9012E+05 | .1190E+00 | .1676E+01 | .6585E+03 |
| vinylchloride | .1953E+02 | .0000E+00 | .0000E+00 | .1427E+00 |
| Ethylbenzene | .4415E+06 | .3564E+00 | .5020E+01 | .3226E+04 |

RESULTS AT TIME (DAYS) 4383.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .3839E+02 | .1035E+06 | .8808E+02 | .4245E+03 |
| toluene | .1151E+04 | .1071E+08 | .2235E+04 | .3909E+05 |
| p-xylene | .1839E+03 | .5768E+07 | .4014E+03 | .2025E+05 |
| 111-trichloroethane | .1472E+03 | .2451E+07 | .1028E+04 | .1159E+05 |
| 1122-tetrachloroethane | .4872E+03 | .1877E+08 | .1211E+05 | .1059E+06 |
| 112-trichloroethane | .5094E+02 | .3435E+06 | .4324E+03 | .4554E+04 |
| 11-dichoroethane | .5527E+01 | .6211E+04 | .7005E+01 | .1543E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .1852E+00 | .1050E+03 | .7342E-01 | .5242E-01 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .1798E+02 | .2020E+07 | .6822E+02 | .9694E+03 |
| trichloroethene | .7865E+02 | .2791E+06 | .8720E+02 | .7472E+03 |
| vinylacetate | .3675E+02 | .6609E+05 | .5736E+02 | .1024E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1243E+03 | .3643E+06 | .1937E+02 | .9750E+03 |

TOTAL MASS IN ALL PHASE = .4109E+05

TOTAL MASS IN GAS PHASE (kg) = .2322E+01
TOTAL MASS IN FREE PHASE (kg) = .4088E+05
TOTAL MASS IN WATER PHASE (kg) = .1653E+02
TOTAL MASS IN SOIL PHASE (kg) = .1845E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .1041E+06 | .9468E-01 | .1334E+01 | .7607E+03 |
| toluene | .1075E+08 | .2834E+01 | .3991E+02 | .7856E+05 |
| p-xylene | .5789E+07 | .4525E+00 | .6373E+01 | .4230E+05 |
| 111-trichloroethane | .2464E+07 | .3622E+00 | .5101E+01 | .1800E+05 |
| 1122-tetrachloroethane | .1889E+08 | .1199E+01 | .1688E+02 | .1380E+06 |
| 112-trichloroethane | .3485E+06 | .1254E+00 | .1766E+01 | .2547E+04 |
| 11-dichoroethane | .6239E+04 | .1368E-01 | .1927E+00 | .4559E+02 |
| 11-dichoroethene | .3110E+02 | .0000E+00 | .0000E+00 | .2272E+00 |
| methylenechloride | .1053E+03 | .4618E-03 | .6504E-02 | .7692E+00 |
| tetrachloroethene | .2022E+07 | .4421E-01 | .6227E+00 | .1477E+05 |
| trichloroethene | .2800E+06 | .1938E+00 | .2730E+01 | .2046E+04 |
| vinylacetate | .6618E+05 | .9077E-01 | .1278E+01 | .4836E+03 |
| vinylchloride | .1951E+02 | .0000E+00 | .0000E+00 | .1426E+00 |
| Ethylbenzene | .3654E+06 | .3064E+00 | .4315E+01 | .2670E+04 |

RESULTS AT TIME (DAYS) 4748.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .3223E+02 | .8366E+05 | .7394E+02 | .3564E+03 |
| toluene | .1124E+04 | .1006E+08 | .2181E+04 | .3816E+05 |
| p-xylene | .1875E+03 | .5659E+07 | .4092E+03 | .2064E+05 |
| 111-trichloroethane | .1477E+03 | .2366E+07 | .1031E+04 | .1163E+05 |
| 1122-tetrachloroethane | .4983E+03 | .1848E+08 | .1238E+05 | .1083E+06 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .4860E+02 | .3154E+06 | .4126E+03 | .4345E+04 |
| 11-dichoroethane | .3441E+01 | .3722E+04 | .4362E+01 | .9608E+01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .6942E-01 | .3786E+02 | .2752E-01 | .1965E-01 |
| tetrachloroethene | .1857E+02 | .2009E+07 | .7048E+02 | .1001E+04 |
| trichloroethene | .6946E+02 | .2372E+06 | .7702E+02 | .6599E+03 |
| vinylacetate | .2771E+02 | .4795E+05 | .4324E+02 | .7719E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1061E+03 | .2993E+06 | .1653E+02 | .8322E+03 |

TOTAL MASS IN ALL PHASE = .3976E+05

TOTAL MASS IN GAS PHASE (kg) = .2263E+01
TOTAL MASS IN FREE PHASE (kg) = .3956E+05
TOTAL MASS IN WATER PHASE (kg) = .1670E+02
TOTAL MASS IN SOIL PHASE (kg) = .1859E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .8412E+05 | .7949E-01 | .1120E+01 | .6147E+03 |
| toluene | .1010E+08 | .2766E+01 | .3896E+02 | .7381E+05 |
| p-xylene | .5681E+07 | .4612E+00 | .6496E+01 | .4151E+05 |
| 111-trichloroethane | .2379E+07 | .3633E+00 | .5117E+01 | .1738E+05 |
| 1122-tetrachloroethane | .1860E+08 | .1226E+01 | .1726E+02 | .1359E+06 |
| 112-trichloroethane | .3202E+06 | .1196E+00 | .1685E+01 | .2340E+04 |
| 11-dichoroethane | .3740E+04 | .8523E-02 | .1200E+00 | .2733E+02 |
| 11-dichoroethene | .2965E+02 | .0000E+00 | .0000E+00 | .2167E+00 |
| methylenechloride | .3797E+02 | .1731E-03 | .2439E-02 | .2775E+00 |
| tetrachloroethene | .2010E+07 | .4571E-01 | .6438E+00 | .1469E+05 |
| trichloroethene | .2380E+06 | .1712E+00 | .2411E+01 | .1739E+04 |
| vinylacetate | .4802E+05 | .6844E-01 | .9639E+00 | .3509E+03 |
| vinylchloride | .1747E+02 | .0000E+00 | .0000E+00 | .1277E+00 |
| Ethylbenzene | .3002E+06 | .2615E+00 | .3684E+01 | .2194E+04 |

RESULTS AT TIME (DAYS) 5113.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .2684E+02 | .6703E+05 | .6158E+02 | .2968E+03 |

| | | | | |
|---|---|---|---|---|
| toluene | .1095E+04 | .9427E+07 | .2125E+04 | .3717E+05 |
| p-xylene | .1911E+03 | .5548E+07 | .4169E+03 | .2103E+05 |
| 111-trichloroethane | .1480E+03 | .2281E+07 | .1033E+04 | .1165E+05 |
| 1122-tetrachloroethane | .5095E+03 | .1818E+08 | .1266E+05 | .1107E+06 |
| 112-trichloroethane | .4623E+02 | .2886E+06 | .3924E+03 | .4133E+04 |
| 11-dichoroethane | .2101E+01 | .2186E+04 | .2663E+01 | .5866E+01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1919E+02 | .1997E+07 | .7281E+02 | .1035E+04 |
| trichloroethene | .6098E+02 | .2004E+06 | .6761E+02 | .5793E+03 |
| vinylacetate | .2063E+02 | .3435E+05 | .3220E+02 | .5748E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .8987E+02 | .2440E+06 | .1401E+02 | .7051E+03 |

TOTAL MASS IN ALL PHASE = .3847E+05

TOTAL MASS IN GAS PHASE (kg) = .2209E+01
TOTAL MASS IN FREE PHASE (kg) = .3827E+05
TOTAL MASS IN WATER PHASE (kg) = .1688E+02
TOTAL MASS IN SOIL PHASE (kg) = .1873E+03

| SPECIES<br>S | MASS<br>g | CONC<br>WELL GAS<br>g/m3 | CONC<br>SOIL GAS<br>g/m3 | CONC<br>SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .6742E+05 | .6620E-01 | .9324E+00 | .4926E+03 |
| toluene | .9468E+07 | .2694E+01 | .3795E+02 | .6918E+05 |
| p-xylene | .5570E+07 | .4699E+00 | .6618E+01 | .4070E+05 |
| 111-trichloroethane | .2294E+07 | .3640E+00 | .5126E+01 | .1676E+05 |
| 1122-tetrachloroethane | .1830E+08 | .1253E+01 | .1765E+02 | .1337E+06 |
| 112-trichloroethane | .2932E+06 | .1138E+00 | .1603E+01 | .2143E+04 |
| 11-dichoroethane | .2197E+04 | .5205E-02 | .7331E-01 | .1605E+02 |
| 11-dichoroethene | .2892E+02 | .0000E+00 | .0000E+00 | .2114E+00 |
| methylenechloride | .3196E+02 | .0000E+00 | .0000E+00 | .2335E+00 |
| tetrachloroethene | .1998E+07 | .4715E-01 | .6641E+00 | .1460E+05 |
| trichloroethene | .2011E+06 | .1503E+00 | .2117E+01 | .1469E+04 |
| vinylacetate | .3441E+05 | .5098E-01 | .7180E+00 | .2514E+03 |
| vinylchloride | .1746E+02 | .0000E+00 | .0000E+00 | .1276E+00 |
| Ethylbenzene | .2448E+06 | .2216E+00 | .3121E+01 | .1789E+04 |

RESULTS AT TIME (DAYS) 5478.606000

SPECIES ........MASS (g) IN PHASES ....

| | GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .2217E+02 | .5324E+05 | .5085E+02 | .2451E+03 |
| toluene | .1064E+04 | .8812E+07 | .2065E+04 | .3613E+05 |
| p-xylene | .1946E+03 | .5435E+07 | .4247E+03 | .2142E+05 |
| 111-trichloroethane | .1481E+03 | .2196E+07 | .1034E+04 | .1166E+05 |
| 1122-tetrachloroethane | .5209E+03 | .1787E+08 | .1294E+05 | .1132E+06 |
| 112-trichloroethane | .4384E+02 | .2632E+06 | .3722E+03 | .3919E+04 |
| 11-dichoroethane | .1257E+01 | .1257E+04 | .1593E+01 | .3508E+01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1983E+02 | .1984E+07 | .7523E+02 | .1069E+04 |
| trichloroethene | .5320E+02 | .1681E+06 | .5898E+02 | .5054E+03 |
| vinylacetate | .1517E+02 | .2429E+05 | .2368E+02 | .4226E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .7557E+02 | .1973E+06 | .1178E+02 | .5929E+03 |

TOTAL MASS IN ALL PHASE = .3721E+05

TOTAL MASS IN GAS PHASE (kg) = .2159E+01
TOTAL MASS IN FREE PHASE (kg) = .3701E+05
TOTAL MASS IN WATER PHASE (kg) = .1706E+02
TOTAL MASS IN SOIL PHASE (kg) = .1888E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .5356E+05 | .5468E-01 | .7702E+00 | .3914E+03 |
| toluene | .8852E+07 | .2619E+01 | .3688E+02 | .6468E+05 |
| p-xylene | .5457E+07 | .4786E+00 | .6741E+01 | .3987E+05 |
| 111-trichloroethane | .2209E+07 | .3643E+00 | .5131E+01 | .1614E+05 |
| 1122-tetrachloroethane | .1800E+08 | .1281E+01 | .1804E+02 | .1315E+06 |
| 112-trichloroethane | .2676E+06 | .1079E+00 | .1520E+01 | .1955E+04 |
| 11-dichoroethane | .1264E+04 | .3114E-02 | .4386E-01 | .9236E+01 |
| 11-dichoroethene | .2748E+02 | .0000E+00 | .0000E+00 | .2008E+00 |
| methylenechloride | .3052E+02 | .0000E+00 | .0000E+00 | .2230E+00 |
| tetrachloroethene | .1985E+07 | .4875E-01 | .6866E+00 | .1451E+05 |
| trichloroethene | .1687E+06 | .1311E+00 | .1847E+01 | .1233E+04 |
| vinylacetate | .2433E+05 | .3749E-01 | .5280E+00 | .1778E+03 |
| vinylchloride | .1745E+02 | .0000E+00 | .0000E+00 | .1275E+00 |
| Ethylbenzene | .1980E+06 | .1864E+00 | .2625E+01 | .1447E+04 |

RESULTS AT TIME (DAYS) 5478.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .2217E+02 | .5324E+05 | .5085E+02 | .2451E+03 |
| toluene | .1064E+04 | .8812E+07 | .2065E+04 | .3613E+05 |
| p-xylene | .1946E+03 | .5435E+07 | .4247E+03 | .2142E+05 |
| 111-trichloroethane | .1481E+03 | .2196E+07 | .1034E+04 | .1166E+05 |
| 1122-tetrachloroethane | .5209E+03 | .1787E+08 | .1294E+05 | .1132E+06 |
| 112-trichloroethane | .4384E+02 | .2632E+06 | .3722E+03 | .3919E+04 |
| 11-dichoroethane | .1257E+01 | .1257E+04 | .1593E+01 | .3508E+01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1983E+02 | .1984E+07 | .7523E+02 | .1069E+04 |
| trichloroethene | .5320E+02 | .1681E+06 | .5898E+02 | .5054E+03 |
| vinylacetate | .1517E+02 | .2429E+05 | .2368E+02 | .4226E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .7557E+02 | .1973E+06 | .1178E+02 | .5929E+03 |

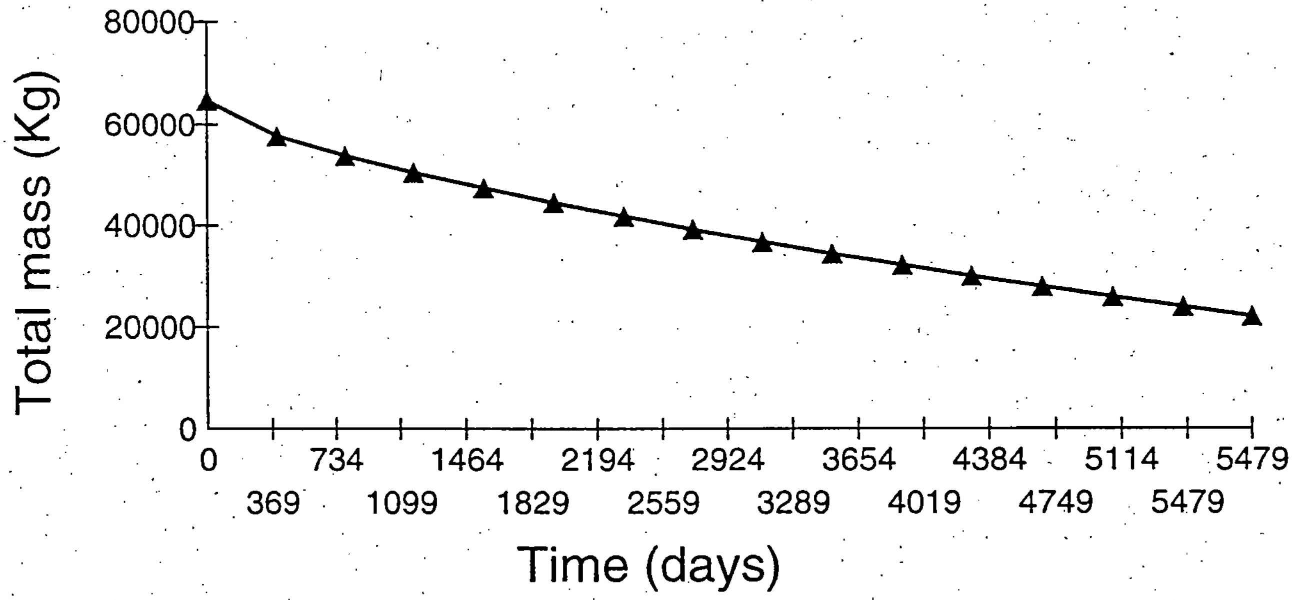
TOTAL MASS IN ALL PHASE = .3721E+05

TOTAL MASS IN GAS PHASE (kg) = .2159E+01
TOTAL MASS IN FREE PHASE (kg) = .3701E+05
TOTAL MASS IN WATER PHASE (kg) = .1706E+02
TOTAL MASS IN SOIL PHASE (kg) = .1888E+03

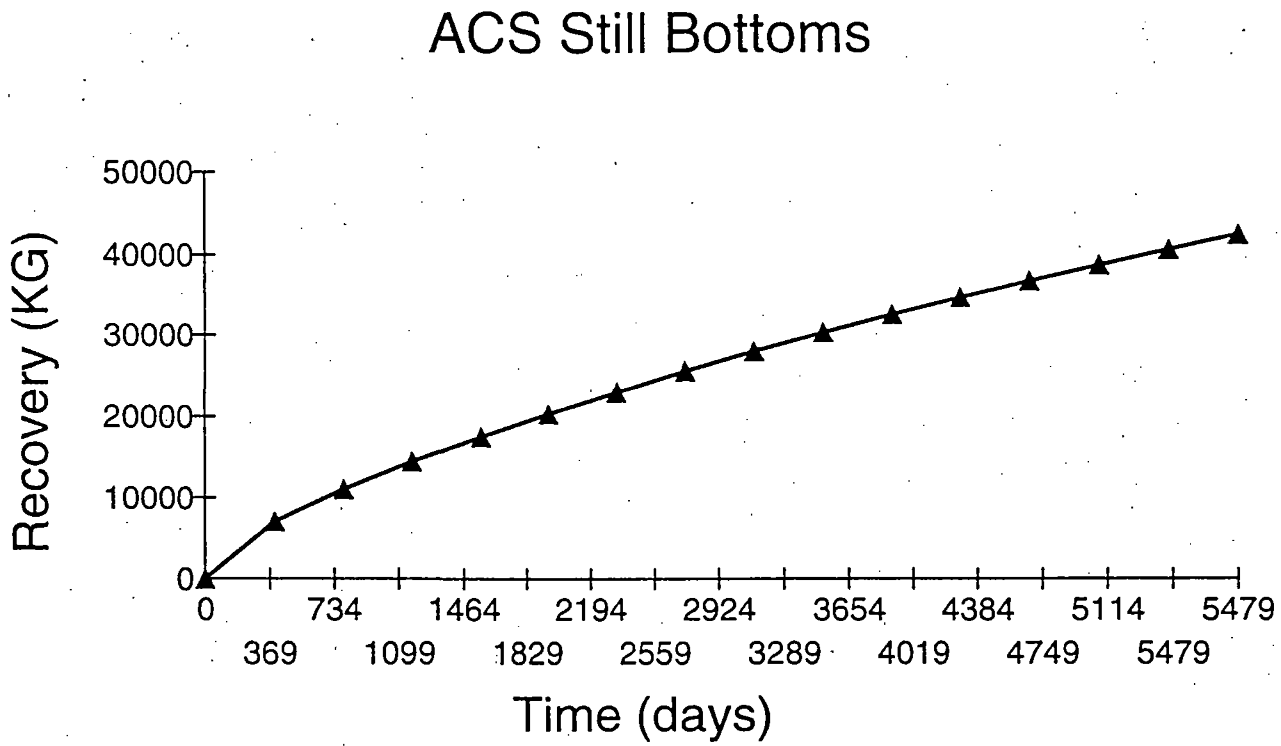
| SPECIES S | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k g |
| benzene | .5356E+05 | .5468E-01 | .7702E+00 | .3914E+03 |
| toluene | .8852E+07 | .2619E+01 | .3688E+02 | .6468E+05 |
| p-xylene | .5457E+07 | .4786E+00 | .6741E+01 | .3987E+05 |
| 111-trichloroethane | .2209E+07 | .3643E+00 | .5131E+01 | .1614E+05 |
| 1122-tetrachloroethane | .1800E+08 | .1281E+01 | .1804E+02 | .1315E+06 |
| 112-trichloroethane | .2676E+06 | .1079E+00 | .1520E+01 | .1955E+04 |
| 11-dichoroethane | .1264E+04 | .3114E-02 | .4386E-01 | .9236E+01 |
| 11-dichoroethene | .2748E+02 | .0000E+00 | .0000E+00 | .2008E+00 |
| methylenechloride | .3052E+02 | .0000E+00 | .0000E+00 | .2230E+00 |
| tetrachloroethene | .1985E+07 | .4875E-01 | .6866E+00 | .1451E+05 |
| trichloroethene | .1687E+06 | .1311E+00 | .1847E+01 | .1233E+04 |
| vinylacetate | .2433E+05 | .3749E-01 | .5280E+00 | .1778E+03 |

| | | | | |
|---|---|---|---|---|
| vinylchloride | .1745E+02 | .0000E+00 | .0000E+00 | .1275E+00 |
| Ethylbenzene | .1980E+06 | .1864E+00 | .2625E+01 | .1447E+04 |

# ACS Still Bottoms




10 darcy


ACS Still Bottoms
Recovery (KG)
50000
40000
30000
20000
10000
0
0
734
1464
2194
2924
3654
4384
5114
5479
369
1099
1829
2559
3289
4019
4749
5479
Time (days)

```
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
+                                                               +
+                     BioSVE For Window                         +
+                                                               +
+   SOIL VACUUM EXTRACTION CHEMICAL EQUILIBRIUM MODEL           +
+      BASED ON JOHNSON ET AL. (1990) GROUND WATER              +
+                                                               +
+                                                               +
+                                                               +
+                                                               +
+                       COPYRIGHT 1995                          +
+                     ASHOK KATYAL, Ph.D.                       +
+             DRAPER ADEN ENVIRONMENTAL MODELING                +
+               BLACKSBURG, VA 24060, U.S.A.                    +
+                                                               +
+                                                               +
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +
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TITLE: ACS Still Bottoms

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```
air flow rate    (liters/day)          = .1208E+07
total mass of contaminant (g)          = .6471E+08
maximum simulation time (days)         = .5475E+04
starting time step (days)              = .5000E+00
maximum time step  (days)              = .5000E+01
time increment factor                  =.10200E+01
printout time interval (days)          =.36500E+03
volumetric water content(fraction)     =.15000E+00
bulk density (g/cm^3)                  =.17000E+01
foc                                    =.50000E-02
contaminated soil vol. (m^3)           =.80500E+02
temperature (C)                        =.20000E+02
intercept in free prod.recov.eqn.      =.15000E+01
exponent in free prod. recov. eqn.     =.20000E-01
bio efficiency (fraction)              =.20000E-01
residual oil mass (kg)                 =.64710E+04
venting efficiency (fraction)          = .7100E-01
```

| SPECIES | VAP PRES atm | BOILING POINT deg C | SOL LIMIT ppm | KOW g/g |
|---|---|---|---|---|
| benzene | .1000E+00 | .8000E+02 | .1780E+04 | .1350E+03 |
| toluene | .2900E-01 | .1110E+03 | .5150E+03 | .4900E+03 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .8600E-02 | .1380E+03 | .1980E+03 | .1413E+04 |
| 111-trichloroethane | .1620E-01 | .7410E+02 | .1500E+04 | .3160E+03 |
| 1122-tetrachloroethane | .7000E-02 | .1462E+03 | .2900E+04 | .2450E+03 |
| 112-trichloroethane | .4000E-01 | .1138E+03 | .4500E+04 | .2950E+03 |
| 11-dichoroethane | .2400E+00 | .5750E+02 | .5500E+04 | .6170E+02 |
| 11-dichoroethene | .7900E+00 | .3700E+02 | .2250E+04 | .6920E+02 |
| methylenechloride | .4760E+00 | .9370E+02 | .2000E+04 | .2000E+02 |
| tetrachloroethene | .2400E-02 | .1210E+03 | .1500E+03 | .3980E+03 |
| trichloroethene | .7600E-01 | .8720E+02 | .1100E+04 | .2400E+03 |
| vinylacetate | .1500E+00 | .7200E+02 | .2000E+04 | .5000E+00 |
| vinylchloride | .3500E+01 | .1340E+02 | .2670E+04 | .2400E+02 |
| Ethylbenzene | .9200E-01 | .1362E+03 | .1520E+03 | .1410E+04 |
| MASS FRACTION SUM | 1.000000 | | | |

| SPECIES | MOL WEIGHT g/mol | HENRY COEFF DIMENSIONLESS |
|---|---|---|
| benzene | .7810E+02 | .0000E+00 |
| toluene | .9210E+02 | .0000E+00 |
| p-xylene | .1062E+03 | .0000E+00 |
| 111-trichloroethane | .1335E+03 | .0000E+00 |
| 1122-tetrachloroethane | .1678E+03 | .0000E+00 |
| 112-trichloroethane | .1334E+03 | .0000E+00 |
| 11-dichoroethane | .1820E+03 | .0000E+00 |
| 11-dichoroethene | .9694E+02 | .0000E+00 |
| methylenechloride | .1067E+03 | .0000E+00 |
| tetrachloroethene | .1658E+03 | .0000E+00 |
| trichloroethene | .1314E+03 | .0000E+00 |
| vinylacetate | .8600E+02 | .0000E+00 |
| vinylchloride | .6250E+02 | .0000E+00 |
| Ethylbenzene | .1067E+03 | .0000E+00 |

sgmlti 556024.500000

RESULTS AT TIME (DAYS) 0.000000E+00

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1673E+03 | .7742E+06 | .3838E+03 | .1850E+04 |
| toluene | .1210E+04 | .1930E+08 | .2348E+04 | .4107E+05 |
| p-xylene | .1284E+03 | .6910E+07 | .2802E+03 | .1414E+05 |
| 111-trichloroethane | .1197E+03 | .3419E+07 | .8357E+03 | .9428E+04 |
| 1122-tetrachloroethane | .3296E+03 | .2179E+08 | .8191E+04 | .7164E+05 |
| 112-trichloroethane | .6655E+02 | .7700E+06 | .5650E+03 | .5950E+04 |
| 11-dichoroethane | .4017E+03 | .7745E+06 | .5091E+03 | .1121E+04 |

| | | | | |
|---|---|---|---|---|
| 11-dichoroethene | .1321E+04 | .7739E+06 | .3907E+03 | .9652E+03 |
| methylenechloride | .1595E+04 | .1550E+07 | .6322E+03 | .4514E+03 |
| tetrachloroethene | .1107E+02 | .2135E+07 | .4201E+02 | .5969E+03 |
| trichloroethene | .2122E+03 | .1292E+07 | .2352E+03 | .2015E+04 |
| vinylacetate | .4401E+03 | .1358E+07 | .6869E+03 | .1226E+02 |
| vinylchloride | .1014E+05 | .1341E+07 | .4360E+04 | .3736E+04 |
| Ethylbenzene | .4623E+03 | .2326E+07 | .7206E+02 | .3627E+04 |

TOTAL MASS IN ALL PHASE = .6471E+05

TOTAL MASS IN GAS PHASE (kg) = .1660E+02
TOTAL MASS IN FREE PHASE (kg) = .6452E+05
TOTAL MASS IN WATER PHASE (kg) = .1953E+02
TOTAL MASS IN SOIL PHASE (kg) = .1566E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| toluene | .1935E+08 | .0000E+00 | .0000E+00 | .1414E+06 |
| p-xylene | .6924E+07 | .0000E+00 | .0000E+00 | .5060E+05 |
| 111-trichloroethane | .3430E+07 | .0000E+00 | .0000E+00 | .2506E+05 |
| 1122-tetrachloroethane | .2187E+08 | .0000E+00 | .0000E+00 | .1598E+06 |
| 112-trichloroethane | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| 11-dichoroethane | .7766E+06 | .0000E+00 | .0000E+00 | .5675E+04 |
| 11-dichoroethene | .7766E+06 | .7835E-04 | .1103E-02 | .5675E+04 |
| methylenechloride | .1553E+07 | .0000E+00 | .0000E+00 | .1135E+05 |
| tetrachloroethene | .2136E+07 | .0000E+00 | .0000E+00 | .1561E+05 |
| trichloroethene | .1294E+07 | .0000E+00 | .0000E+00 | .9458E+04 |
| vinylacetate | .1359E+07 | .0000E+00 | .0000E+00 | .9931E+04 |
| vinylchloride | .1359E+07 | .4041E-03 | .5692E-02 | .9931E+04 |
| Ethylbenzene | .2330E+07 | .0000E+00 | .0000E+00 | .1702E+05 |

end of initial conditions

RESULTS AT TIME (DAYS) 368.606000

| SPECIES | ........MASS (g) IN PHASES ....<br>GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1492E+03 | .5968E+06 | .3423E+03 | .1650E+04 |
| toluene | .1297E+04 | .1789E+08 | .2517E+04 | .4403E+05 |

| | | | | |
|---|---|---|---|---|
| p-xylene | .1451E+03 | .6750E+07 | .3167E+03 | .1598E+05 |
| 111-trichloroethane | .1326E+03 | .3275E+07 | .9260E+03 | .1045E+05 |
| 1122-tetrachloroethane | .3740E+03 | .2137E+08 | .9294E+04 | .8129E+05 |
| 112-trichloroethane | .6932E+02 | .6932E+06 | .5885E+03 | .6198E+04 |
| 11-dichoroethane | .2491E+03 | .4152E+06 | .3157E+03 | .6955E+03 |
| 11-dichoroethene | .1951E+03 | .9878E+05 | .5770E+02 | .1425E+03 |
| methylenechloride | .5343E+03 | .4490E+06 | .2118E+03 | .1512E+03 |
| tetrachloroethene | .1272E+02 | .2120E+07 | .4826E+02 | .6857E+03 |
| trichloroethene | .2013E+03 | .1060E+07 | .2232E+03 | .1913E+04 |
| vinylacetate | .3446E+03 | .9190E+06 | .5379E+03 | .9601E+01 |
| vinylchloride | .1136E+01 | .1298E+03 | .4886E+00 | .4186E+00 |
| Ethylbenzene | .4209E+03 | .1830E+07 | .6561E+02 | .3303E+04 |

TOTAL MASS IN ALL PHASE = .5765E+05

TOTAL MASS IN GAS PHASE (kg) = .4126E+01
TOTAL MASS IN FREE PHASE (kg) = .5746E+05
TOTAL MASS IN WATER PHASE (kg) = .1544E+02
TOTAL MASS IN SOIL PHASE (kg) = .1665E+03

| SPECIES | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .5989E+06 | .3680E+00 | .5183E+01 | .4377E+04 |
| toluene | .1793E+08 | .3190E+01 | .4493E+02 | .1310E+06 |
| p-xylene | .6766E+07 | .3567E+00 | .5024E+01 | .4944E+05 |
| 111-trichloroethane | .3286E+07 | .3261E+00 | .4593E+01 | .2401E+05 |
| 1122-tetrachloroethane | .2146E+08 | .9193E+00 | .1295E+02 | .1568E+06 |
| 112-trichloroethane | .7000E+06 | .1706E+00 | .2403E+01 | .5115E+04 |
| 11-dichoroethane | .4164E+06 | .6176E+00 | .8699E+01 | .3043E+04 |
| 11-dichoroethene | .9919E+05 | .4939E+00 | .6956E+01 | .7248E+03 |
| methylenechloride | .4499E+06 | .1336E+01 | .1882E+02 | .3287E+04 |
| tetrachloroethene | .2120E+07 | .3125E-01 | .4401E+00 | .1549E+05 |
| trichloroethene | .1062E+07 | .4962E+00 | .6988E+01 | .7760E+04 |
| vinylacetate | .9199E+06 | .8516E+00 | .1199E+02 | .6722E+04 |
| vinylchloride | .1322E+03 | .3200E-02 | .4507E-01 | .9658E+00 |
| Ethylbenzene | .1834E+07 | .1038E+01 | .1462E+02 | .1340E+05 |

RESULTS AT TIME (DAYS) 733.606000

SPECIES ........MASS (g) IN PHASES ....
GAS OIL WATER SOLID

| | | | | |
|---|---|---|---|---|
| benzene | .1220E+03 | .4494E+06 | .2800E+03 | .1349E+04 |
| toluene | .1296E+04 | .1646E+08 | .2516E+04 | .4401E+05 |
| p-xylene | .1537E+03 | .6580E+07 | .3353E+03 | .1691E+05 |
| 111-trichloroethane | .1374E+03 | .3125E+07 | .9596E+03 | .1083E+05 |
| 1122-tetrachloroethane | .3978E+03 | .2093E+08 | .9884E+04 | .8645E+05 |
| 112-trichloroethane | .6718E+02 | .6186E+06 | .5703E+03 | .6006E+04 |
| 11-dichoroethane | .1369E+03 | .2101E+06 | .1735E+03 | .3822E+03 |
| 11-dichoroethene | .2208E+02 | .1029E+05 | .6529E+01 | .1613E+02 |
| methylenechloride | .1493E+03 | .1155E+06 | .5918E+02 | .4226E+02 |
| tetrachloroethene | .1371E+02 | .2103E+07 | .5201E+02 | .7390E+03 |
| trichloroethene | .1762E+03 | .8538E+06 | .1954E+03 | .1674E+04 |
| vinylacetate | .2444E+03 | .6001E+06 | .3814E+03 | .6808E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3520E+03 | .1409E+07 | .5487E+02 | .2762E+04 |

TOTAL MASS IN ALL PHASE = .5365E+05

TOTAL MASS IN GAS PHASE (kg) = .3269E+01
TOTAL MASS IN FREE PHASE (kg) = .5346E+05
TOTAL MASS IN WATER PHASE (kg) = .1547E+02
TOTAL MASS IN SOIL PHASE (kg) = .1712E+03

| SPECIES<br>S | MASS<br>g | CONC<br>WELL GAS<br>g/m3 | CONC<br>SOIL GAS<br>g/m3 | CONC<br>SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .4511E+06 | .3011E+00 | .4241E+01 | .3297E+04 |
| toluene | .1651E+08 | .3189E+01 | .4492E+02 | .1206E+06 |
| p-xylene | .6597E+07 | .3778E+00 | .5321E+01 | .4821E+05 |
| 111-trichloroethane | .3136E+07 | .3380E+00 | .4761E+01 | .2292E+05 |
| 1122-tetrachloroethane | .2102E+08 | .9779E+00 | .1377E+02 | .1536E+06 |
| 112-trichloroethane | .6252E+06 | .1654E+00 | .2329E+01 | .4569E+04 |
| 11-dichoroethane | .2108E+06 | .3397E+00 | .4785E+01 | .1540E+04 |
| 11-dichoroethene | .1034E+05 | .5604E-01 | .7893E+00 | .7555E+02 |
| methylenechloride | .1158E+06 | .3741E+00 | .5269E+01 | .8460E+03 |
| tetrachloroethene | .2104E+07 | .3369E-01 | .4745E+00 | .1538E+05 |
| trichloroethene | .8559E+06 | .4344E+00 | .6118E+01 | .6254E+04 |
| vinylacetate | .6007E+06 | .6043E+00 | .8512E+01 | .4389E+04 |
| vinylchloride | .2517E+02 | .0000E+00 | .0000E+00 | .1840E+00 |
| Ethylbenzene | .1412E+07 | .8684E+00 | .1223E+02 | .1032E+05 |

RESULTS AT TIME (DAYS) 1098.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .9680E+02 | .3307E+06 | .2221E+03 | .1070E+04 |
| toluene | .1277E+04 | .1505E+08 | .2479E+04 | .4337E+05 |
| p-xylene | .1611E+03 | .6402E+07 | .3517E+03 | .1774E+05 |
| 111-trichloroethane | .1408E+03 | .2970E+07 | .9833E+03 | .1109E+05 |
| 1122-tetrachloroethane | .4192E+03 | .2046E+08 | .1042E+05 | .9110E+05 |
| 112-trichloroethane | .6404E+02 | .5470E+06 | .5437E+03 | .5726E+04 |
| 11-dichoroethane | .7064E+02 | .1006E+06 | .8954E+02 | .1972E+03 |
| 11-dichoroethene | .2059E+01 | .8904E+03 | .6090E+00 | .1504E+01 |
| methylenechloride | .3705E+02 | .2660E+05 | .1469E+02 | .1049E+02 |
| tetrachloroethene | .1465E+02 | .2086E+07 | .5560E+02 | .7900E+03 |
| trichloroethene | .1504E+03 | .6760E+06 | .1667E+03 | .1429E+04 |
| vinylacetate | .1662E+03 | .3785E+06 | .2593E+03 | .4629E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2861E+03 | .1062E+07 | .4459E+02 | .2245E+04 |

TOTAL MASS IN ALL PHASE = .5028E+05

TOTAL MASS IN GAS PHASE (kg) = .2886E+01
TOTAL MASS IN FREE PHASE (kg) = .5009E+05
TOTAL MASS IN WATER PHASE (kg) = .1563E+02
TOTAL MASS IN SOIL PHASE (kg) = .1748E+03

| SPECIES<br>S<br>g | MASS<br>g | CONC<br>WELL GAS<br>g/m3 | CONC<br>SOIL GAS<br>g/m3 | CONC<br>SOIL MAS<br>mg/k |
|---|---|---|---|---|
| benzene | .3321E+06 | .2390E+00 | .3366E+01 | .2427E+04 |
| toluene | .1509E+08 | .3143E+01 | .4427E+02 | .1103E+06 |
| p-xylene | .6420E+07 | .3963E+00 | .5581E+01 | .4691E+05 |
| 111-trichloroethane | .2982E+07 | .3464E+00 | .4879E+01 | .2179E+05 |
| 1122-tetrachloroethane | .2056E+08 | .1030E+01 | .1451E+02 | .1502E+06 |
| 112-trichloroethane | .5533E+06 | .1577E+00 | .2221E+01 | .4043E+04 |
| 11-dichoroethane | .1009E+06 | .1755E+00 | .2471E+01 | .7375E+03 |
| 11-dichoroethene | .8948E+03 | .5240E-02 | .7380E-01 | .6538E+01 |
| methylenechloride | .2666E+05 | .9299E-01 | .1310E+01 | .1948E+03 |
| tetrachloroethene | .2087E+07 | .3602E-01 | .5073E+00 | .1525E+05 |
| trichloroethene | .6778E+06 | .3708E+00 | .5223E+01 | .4953E+04 |
| vinylacetate | .3789E+06 | .4111E+00 | .5790E+01 | .2769E+04 |
| vinylchloride | .2515E+02 | .0000E+00 | .0000E+00 | .1838E+00 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .1065E+07 | .7060E+00 | .9943E+01 | .7782E+04 |

RESULTS AT TIME (DAYS) 1463.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .7485E+02 | .2377E+06 | .1717E+03 | .8276E+03 |
| toluene | .1247E+04 | .1366E+08 | .2421E+04 | .4235E+05 |
| p-xylene | .1683E+03 | .6215E+07 | .3672E+03 | .1852E+05 |
| 111-trichloroethane | .1434E+03 | .2812E+07 | .1001E+04 | .1130E+05 |
| 1122-tetrachloroethane | .4399E+03 | .1996E+08 | .1093E+05 | .9562E+05 |
| 112-trichloroethane | .6035E+02 | .4792E+06 | .5123E+03 | .5395E+04 |
| 11-dichoroethane | .3438E+02 | .4550E+05 | .4357E+02 | .9598E+02 |
| 11-dichoroethene | .1585E+00 | .6373E+02 | .4687E-01 | .1158E+00 |
| methylenechloride | .8193E+01 | .5467E+04 | .3248E+01 | .2319E+01 |
| tetrachloroethene | .1562E+02 | .2067E+07 | .5926E+02 | .8420E+03 |
| trichloroethene | .1258E+03 | .5258E+06 | .1395E+03 | .1195E+04 |
| vinylacetate | .1088E+03 | .2304E+06 | .1698E+03 | .3031E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2270E+03 | .7838E+06 | .3538E+02 | .1781E+04 |

TOTAL MASS IN ALL PHASE = .4723E+05

TOTAL MASS IN GAS PHASE (kg) = .2654E+01
TOTAL MASS IN FREE PHASE (kg) = .4703E+05
TOTAL MASS IN WATER PHASE (kg) = .1586E+02
TOTAL MASS IN SOIL PHASE (kg) = .1779E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .2388E+06 | .1848E+00 | .2603E+01 | .1745E+04 |
| toluene | .1371E+08 | .3070E+01 | .4324E+02 | .1002E+06 |
| p-xylene | .6234E+07 | .4138E+00 | .5828E+01 | .4556E+05 |
| 111-trichloroethane | .2825E+07 | .3528E+00 | .4969E+01 | .2064E+05 |
| 1122-tetrachloroethane | .2007E+08 | .1082E+01 | .1523E+02 | .1467E+06 |
| 112-trichloroethane | .4852E+06 | .1486E+00 | .2093E+01 | .3546E+04 |
| 11-dichoroethane | .4568E+05 | .8545E-01 | .1204E+01 | .3338E+03 |
| 11-dichoroethene | .6406E+02 | .4044E-03 | .5696E-02 | .4681E+00 |
| methylenechloride | .5481E+04 | .2059E-01 | .2901E+00 | .4005E+02 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .2068E+07 | .3838E-01 | .5405E+00 | .1511E+05 |
| trichloroethene | .5273E+06 | .3103E+00 | .4370E+01 | .3853E+04 |
| vinylacetate | .2307E+06 | .2693E+00 | .3793E+01 | .1686E+04 |
| vinylchloride | .2122E+02 | .0000E+00 | .0000E+00 | .1551E+00 |
| Ethylbenzene | .7858E+06 | .5604E+00 | .7892E+01 | .5742E+04 |

RESULTS AT TIME (DAYS) 1828.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .5643E+02 | .1667E+06 | .1295E+03 | .6239E+03 |
| toluene | .1209E+04 | .1232E+08 | .2346E+04 | .4104E+05 |
| p-xylene | .1752E+03 | .6021E+07 | .3824E+03 | .1929E+05 |
| 111-trichloroethane | .1454E+03 | .2652E+07 | .1015E+04 | .1145E+05 |
| 1122-tetrachloroethane | .4607E+03 | .1945E+08 | .1145E+05 | .1001E+06 |
| 112-trichloroethane | .5628E+02 | .4158E+06 | .4778E+03 | .5032E+04 |
| 11-dichoroethane | .1575E+02 | .1939E+05 | .1996E+02 | .4398E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .1606E+01 | .9969E+03 | .6365E+00 | .4545E+00 |
| tetrachloroethene | .1663E+02 | .2047E+07 | .6309E+02 | .8964E+03 |
| trichloroethene | .1032E+03 | .4013E+06 | .1144E+03 | .9805E+03 |
| vinylacetate | .6859E+02 | .1351E+06 | .1071E+03 | .1911E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1760E+03 | .5652E+06 | .2743E+02 | .1381E+04 |

TOTAL MASS IN ALL PHASE = .4439E+05

TOTAL MASS IN GAS PHASE (kg) = .2484E+01
TOTAL MASS IN FREE PHASE (kg) = .4419E+05
TOTAL MASS IN WATER PHASE (kg) = .1613E+02
TOTAL MASS IN SOIL PHASE (kg) = .1809E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .1676E+06 | .1394E+00 | .1963E+01 | .1224E+04 |
| toluene | .1236E+08 | .2975E+01 | .4190E+02 | .9032E+05 |
| p-xylene | .6041E+07 | .4309E+00 | .6069E+01 | .4414E+05 |
| 111-trichloroethane | .2665E+07 | .3577E+00 | .5038E+01 | .1947E+05 |
| 1122-tetrachloroethane | .1956E+08 | .1133E+01 | .1596E+02 | .1429E+06 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .4214E+06 | .1386E+00 | .1952E+01 | .3079E+04 |
| 11-dichoroethane | .1947E+05 | .3919E-01 | .5519E+00 | .1423E+03 |
| 11-dichoroethene | .3360E+02 | .0000E+00 | .0000E+00 | .2455E+00 |
| methylenechloride | .9996E+03 | .4043E-02 | .5695E-01 | .7305E+01 |
| tetrachloroethene | .2048E+07 | .4087E-01 | .5756E+00 | .1497E+05 |
| trichloroethene | .4025E+06 | .2547E+00 | .3587E+01 | .2941E+04 |
| vinylacetate | .1353E+06 | .1699E+00 | .2393E+01 | .9887E+03 |
| vinylchloride | .2120E+02 | .0000E+00 | .0000E+00 | .1549E+00 |
| Ethylbenzene | .5668E+06 | .4345E+00 | .6120E+01 | .4142E+04 |

RESULTS AT TIME (DAYS) 2193.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .4144E+02 | .1139E+06 | .9507E+02 | .4582E+03 |
| toluene | .1162E+04 | .1102E+08 | .2256E+04 | .3947E+05 |
| p-xylene | .1821E+03 | .5819E+07 | .3974E+03 | .2005E+05 |
| 111-trichloroethane | .1468E+03 | .2491E+07 | .1025E+04 | .1156E+05 |
| 1122-tetrachloroethane | .4817E+03 | .1891E+08 | .1197E+05 | .1047E+06 |
| 112-trichloroethane | .5196E+02 | .3570E+06 | .4411E+03 | .4645E+04 |
| 11-dichoroethane | .6771E+01 | .7753E+04 | .8582E+01 | .1890E+02 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .2767E+00 | .1598E+03 | .1097E+00 | .7833E-01 |
| tetrachloroethene | .1769E+02 | .2026E+07 | .6714E+02 | .9540E+03 |
| trichloroethene | .8301E+02 | .3002E+06 | .9204E+02 | .7886E+03 |
| vinylacetate | .4156E+02 | .7613E+05 | .6486E+02 | .1158E+01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1332E+03 | .3977E+06 | .2075E+02 | .1045E+04 |

TOTAL MASS IN ALL PHASE = .4171E+05

TOTAL MASS IN GAS PHASE (kg) = .2349E+01
TOTAL MASS IN FREE PHASE (kg) = .4151E+05
TOTAL MASS IN WATER PHASE (kg) = .1644E+02
TOTAL MASS IN SOIL PHASE (kg) = .1837E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|
| S | | | | |
| | g | g/m3 | g/m3 | mg/k |
| g | | | | |
| benzene | .1145E+06 | .1024E+00 | .1442E+01 | .8365E+03 |

| | | | | |
|---|---|---|---|---|
| toluene | .1106E+08 | .2862E+01 | .4030E+02 | .8080E+05 |
| p-xylene | .5840E+07 | .4478E+00 | .6308E+01 | .4267E+05 |
| 111-trichloroethane | .2503E+07 | .3612E+00 | .5087E+01 | .1829E+05 |
| 1122-tetrachloroethane | .1903E+08 | .1184E+01 | .1668E+02 | .1390E+06 |
| 112-trichloroethane | .3621E+06 | .1280E+00 | .1803E+01 | .2646E+04 |
| 11-dichoroethane | .7787E+04 | .1686E-01 | .2375E+00 | .5690E+02 |
| 11-dichoroethene | .3083E+02 | .0000E+00 | .0000E+00 | .2253E+00 |
| methylenechloride | .1602E+03 | .6981E-03 | .9832E-02 | .1171E+01 |
| tetrachloroethene | .2027E+07 | .4350E-01 | .6126E+00 | .1481E+05 |
| trichloroethene | .3011E+06 | .2049E+00 | .2886E+01 | .2200E+04 |
| vinylacetate | .7624E+05 | .1030E+00 | .1450E+01 | .5571E+03 |
| vinylchloride | .1727E+02 | .0000E+00 | .0000E+00 | .1262E+00 |
| Ethylbenzene | .3989E+06 | .3289E+00 | .4632E+01 | .2915E+04 |

RESULTS AT TIME (DAYS) 2558.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .2960E+02 | .7556E+05 | .6790E+02 | .3272E+03 |
| toluene | .1110E+04 | .9770E+07 | .2154E+04 | .3768E+05 |
| p-xylene | .1890E+03 | .5610E+07 | .4123E+03 | .2080E+05 |
| 111-trichloroethane | .1477E+03 | .2327E+07 | .1031E+04 | .1163E+05 |
| 1122-tetrachloroethane | .5029E+03 | .1834E+08 | .1250E+05 | .1093E+06 |
| 112-trichloroethane | .4747E+02 | .3030E+06 | .4030E+03 | .4244E+04 |
| 11-dichoroethane | .2717E+01 | .2891E+04 | .3444E+01 | .7586E+01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .1883E+02 | .2003E+07 | .7146E+02 | .1015E+04 |
| trichloroethene | .6537E+02 | .2196E+06 | .7249E+02 | .6211E+03 |
| vinylacetate | .2412E+02 | .4106E+05 | .3765E+02 | .6720E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .9819E+02 | .2725E+06 | .1531E+02 | .7704E+03 |

TOTAL MASS IN ALL PHASE = .3917E+05

TOTAL MASS IN GAS PHASE (kg) = .2236E+01
TOTAL MASS IN FREE PHASE (kg) = .3897E+05
TOTAL MASS IN WATER PHASE (kg) = .1677E+02
TOTAL MASS IN SOIL PHASE (kg) = .1864E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS |
|---|---|---|---|---|

S

| | g | g/m3 | g/m3 | mg/k |
|---|---|---|---|---|
| g | | | | |
| benzene | .7599E+05 | .7316E-01 | .1030E+01 | .5553E+03 |
| toluene | .9811E+07 | .2732E+01 | .3848E+02 | .7169E+05 |
| p-xylene | .5631E+07 | .4646E+00 | .6544E+01 | .4115E+05 |
| 111-trichloroethane | .2340E+07 | .3633E+00 | .5117E+01 | .1710E+05 |
| 1122-tetrachloroethane | .1847E+08 | .1237E+01 | .1742E+02 | .1349E+06 |
| 112-trichloroethane | .3077E+06 | .1169E+00 | .1647E+01 | .2248E+04 |
| 11-dichoroethane | .2905E+04 | .6773E-02 | .9539E-01 | .2123E+02 |
| 11-dichoroethene | .2942E+02 | .0000E+00 | .0000E+00 | .2150E+00 |
| methylenechloride | .3204E+02 | .0000E+00 | .0000E+00 | .2342E+00 |
| tetrachloroethene | .2005E+07 | .4628E-01 | .6519E+00 | .1465E+05 |
| trichloroethene | .2204E+06 | .1614E+00 | .2273E+01 | .1610E+04 |
| vinylacetate | .4113E+05 | .5981E-01 | .8425E+00 | .3005E+03 |
| vinylchloride | .1725E+02 | .0000E+00 | .0000E+00 | .1260E+00 |
| Ethylbenzene | .2734E+06 | .2426E+00 | .3417E+01 | .1998E+04 |

RESULTS AT TIME (DAYS) 2923.606000

| SPECIES | ........MASS (g) IN PHASES .... | | | |
|---|---|---|---|---|
| | GAS | OIL | WATER | SOLID |
| benzene | .2051E+02 | .4859E+05 | .4705E+02 | .2268E+03 |
| toluene | .1051E+04 | .8586E+07 | .2040E+04 | .3569E+05 |
| p-xylene | .1958E+03 | .5392E+07 | .4272E+03 | .2155E+05 |
| 111-trichloroethane | .1480E+03 | .2164E+07 | .1033E+04 | .1165E+05 |
| 1122-tetrachloroethane | .5247E+03 | .1776E+08 | .1304E+05 | .1140E+06 |
| 112-trichloroethane | .4288E+02 | .2540E+06 | .3640E+03 | .3834E+04 |
| 11-dichoroethane | .1012E+01 | .9989E+03 | .1283E+01 | .2825E+01 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2005E+02 | .1980E+07 | .7610E+02 | .1081E+04 |
| trichloroethene | .5033E+02 | .1569E+06 | .5580E+02 | .4781E+03 |
| vinylacetate | .1337E+02 | .2112E+05 | .2087E+02 | .3725E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .7043E+02 | .1814E+06 | .1098E+02 | .5526E+03 |

TOTAL MASS IN ALL PHASE = .3675E+05

TOTAL MASS IN GAS PHASE (kg) = .2138E+01
TOTAL MASS IN FREE PHASE (kg) = .3654E+05
TOTAL MASS IN WATER PHASE (kg) = .1711E+02
TOTAL MASS IN SOIL PHASE (kg) = .1891E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .4888E+05 | .5072E-01 | .7144E+00 | .3572E+03 |
| toluene | .8625E+07 | .2588E+01 | .3645E+02 | .6302E+05 |
| p-xylene | .5415E+07 | .4813E+00 | .6780E+01 | .3957E+05 |
| 111-trichloroethane | .2177E+07 | .3640E+00 | .5127E+01 | .1591E+05 |
| 1122-tetrachloroethane | .1788E+08 | .1290E+01 | .1817E+02 | .1307E+06 |
| 112-trichloroethane | .2582E+06 | .1057E+00 | .1488E+01 | .1887E+04 |
| 11-dichoroethane | .1004E+04 | .2525E-02 | .3556E-01 | .7337E+01 |
| 11-dichoroethene | .2665E+02 | .0000E+00 | .0000E+00 | .1948E+00 |
| methylenechloride | .3019E+02 | .0000E+00 | .0000E+00 | .2206E+00 |
| tetrachloroethene | .1981E+07 | .4931E-01 | .6945E+00 | .1447E+05 |
| trichloroethene | .1575E+06 | .1243E+00 | .1751E+01 | .1151E+04 |
| vinylacetate | .2115E+05 | .3317E-01 | .4672E+00 | .1546E+03 |
| vinylchloride | .1722E+02 | .0000E+00 | .0000E+00 | .1259E+00 |
| Ethylbenzene | .1820E+06 | .1741E+00 | .2452E+01 | .1330E+04 |

RESULTS AT TIME (DAYS) 3288.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1375E+02 | .3018E+05 | .3155E+02 | .1521E+03 |
| toluene | .9871E+03 | .7469E+07 | .1916E+04 | .3352E+05 |
| p-xylene | .2025E+03 | .5168E+07 | .4420E+03 | .2230E+05 |
| 111-trichloroethane | .1477E+03 | .2000E+07 | .1031E+04 | .1163E+05 |
| 1122-tetrachloroethane | .5469E+03 | .1714E+08 | .1359E+05 | .1189E+06 |
| 112-trichloroethane | .3828E+02 | .2100E+06 | .3250E+03 | .3423E+04 |
| 11-dichoroethane | .3472E+00 | .3174E+03 | .4401E+00 | .9693E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2137E+02 | .1954E+07 | .8110E+02 | .1152E+04 |
| trichloroethene | .3780E+02 | .1091E+06 | .4192E+02 | .3591E+03 |
| vinylacetate | .7044E+01 | .1031E+05 | .1099E+02 | .1962E+00 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .4901E+02 | .1169E+06 | .7640E+01 | .3846E+03 |

TOTAL MASS IN ALL PHASE = .3442E+05

TOTAL MASS IN GAS PHASE (kg) = .2052E+01
TOTAL MASS IN FREE PHASE (kg) = .3421E+05
TOTAL MASS IN WATER PHASE (kg) = .1748E+02

TOTAL MASS IN SOIL PHASE (kg) = .1918E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MAS S |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/k g |
| benzene | .3038E+05 | .3403E-01 | .4793E+00 | .2220E+03 |
| toluene | .7506E+07 | .2431E+01 | .3424E+02 | .5485E+05 |
| p-xylene | .5191E+07 | .4980E+00 | .7015E+01 | .3793E+05 |
| 111-trichloroethane | .2013E+07 | .3633E+00 | .5117E+01 | .1471E+05 |
| 1122-tetrachloroethane | .1728E+08 | .1345E+01 | .1894E+02 | .1262E+06 |
| 112-trichloroethane | .2138E+06 | .9434E-01 | .1329E+01 | .1562E+04 |
| 11-dichoroethane | .3192E+03 | .8673E-03 | .1222E-01 | .2333E+01 |
| 11-dichoroethene | .2525E+02 | .0000E+00 | .0000E+00 | .1845E+00 |
| methylenechloride | .2743E+02 | .0000E+00 | .0000E+00 | .2004E+00 |
| tetrachloroethene | .1955E+07 | .5253E-01 | .7398E+00 | .1429E+05 |
| trichloroethene | .1096E+06 | .9339E-01 | .1315E+01 | .8008E+03 |
| vinylacetate | .1032E+05 | .1749E-01 | .2463E+00 | .7544E+02 |
| vinylchloride | .1330E+02 | .0000E+00 | .0000E+00 | .9718E-01 |
| Ethylbenzene | .1174E+06 | .1212E+00 | .1707E+01 | .8575E+03 |

RESULTS AT TIME (DAYS) 3653.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .8894E+01 | .1804E+05 | .2041E+02 | .9834E+02 |
| toluene | .9188E+03 | .6426E+07 | .1783E+04 | .3120E+05 |
| p-xylene | .2093E+03 | .4936E+07 | .4567E+03 | .2304E+05 |
| 111-trichloroethane | .1468E+03 | .1838E+07 | .1025E+04 | .1156E+05 |
| 1122-tetrachloroethane | .5697E+03 | .1651E+08 | .1416E+05 | .1238E+06 |
| 112-trichloroethane | .3374E+02 | .1711E+06 | .2864E+03 | .3016E+04 |
| 11-dichoroethane | .1088E+00 | .9195E+02 | .1379E+00 | .3038E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2280E+02 | .1927E+07 | .8652E+02 | .1229E+04 |
| trichloroethene | .2763E+02 | .7375E+05 | .3064E+02 | .2625E+03 |
| vinylacetate | .3509E+01 | .4745E+04 | .5477E+01 | .9776E-01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .3299E+02 | .7274E+05 | .5143E+01 | .2589E+03 |

TOTAL MASS IN ALL PHASE = .3219E+05

TOTAL MASS IN GAS PHASE (kg) = .1974E+01
TOTAL MASS IN FREE PHASE (kg) = .3197E+05
TOTAL MASS IN WATER PHASE (kg) = .1785E+02
TOTAL MASS IN SOIL PHASE (kg) = .1945E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .1817E+05 | .2202E-01 | .3101E+00 | .1328E+03 |
| toluene | .6460E+07 | .2263E+01 | .3187E+02 | .4720E+05 |
| p-xylene | .4959E+07 | .5147E+00 | .7249E+01 | .3624E+05 |
| 111-trichloroethane | .1850E+07 | .3611E+00 | .5086E+01 | .1352E+05 |
| 1122-tetrachloroethane | .1664E+08 | .1401E+01 | .1973E+02 | .1216E+06 |
| 112-trichloroethane | .1744E+06 | .8315E-01 | .1171E+01 | .1274E+04 |
| 11-dichoroethane | .9251E+02 | .2721E-03 | .3833E-02 | .6760E+00 |
| 11-dichoroethene | .2248E+02 | .0000E+00 | .0000E+00 | .1643E+00 |
| methylenechloride | .2558E+02 | .0000E+00 | .0000E+00 | .1869E+00 |
| tetrachloroethene | .1928E+07 | .5604E-01 | .7893E+00 | .1409E+05 |
| trichloroethene | .7407E+05 | .6829E-01 | .9619E+00 | .5413E+03 |
| vinylacetate | .4754E+04 | .8720E-02 | .1228E+00 | .3474E+02 |
| vinylchloride | .1328E+02 | .0000E+00 | .0000E+00 | .9703E-01 |
| Ethylbenzene | .7304E+05 | .8163E-01 | .1150E+01 | .5337E+03 |

RESULTS AT TIME (DAYS) 4018.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .5526E+01 | .1033E+05 | .1268E+02 | .6110E+02 |
| toluene | .8466E+03 | .5460E+07 | .1643E+04 | .2875E+05 |
| p-xylene | .2159E+03 | .4696E+07 | .4712E+03 | .2377E+05 |
| 111-trichloroethane | .1452E+03 | .1676E+07 | .1014E+04 | .1144E+05 |
| 1122-tetrachloroethane | .5930E+03 | .1584E+08 | .1473E+05 | .1289E+06 |
| 112-trichloroethane | .2930E+02 | .1370E+06 | .2488E+03 | .2620E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2436E+02 | .1898E+07 | .9243E+02 | .1313E+04 |
| trichloroethene | .1960E+02 | .4824E+05 | .2173E+02 | .1862E+03 |
| vinylacetate | .1643E+01 | .2048E+04 | .2563E+01 | .4576E-01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | .2140E+02 | .4351E+05 | .3336E+01 | .1679E+03 |

TOTAL MASS IN ALL PHASE = .3003E+05

TOTAL MASS IN GAS PHASE (kg) = .1903E+01
TOTAL MASS IN FREE PHASE (kg) = .2981E+05
TOTAL MASS IN WATER PHASE (kg) = .1824E+02
TOTAL MASS IN SOIL PHASE (kg) = .1972E+03

| SPECIES | MASS | CONC WELL GAS | CONC SOIL GAS | CONC SOIL MASS |
|---|---|---|---|---|
| | g | g/m3 | g/m3 | mg/kg |
| benzene | .1041E+05 | .1369E-01 | .1928E+00 | .7610E+02 |
| toluene | .5491E+07 | .2085E+01 | .2937E+02 | .4012E+05 |
| p-xylene | .4720E+07 | .5311E+00 | .7480E+01 | .3449E+05 |
| 111-trichloroethane | .1689E+07 | .3573E+00 | .5032E+01 | .1234E+05 |
| 1122-tetrachloroethane | .1599E+08 | .1458E+01 | .2054E+02 | .1168E+06 |
| 112-trichloroethane | .1399E+06 | .7224E-01 | .1018E+01 | .1022E+04 |
| 11-dichoroethane | .4016E+02 | .0000E+00 | .0000E+00 | .2934E+00 |
| 11-dichoroethene | .2107E+02 | .0000E+00 | .0000E+00 | .1540E+00 |
| methylenechloride | .2372E+02 | .0000E+00 | .0000E+00 | .1733E+00 |
| tetrachloroethene | .1900E+07 | .5987E-01 | .8433E+00 | .1388E+05 |
| trichloroethene | .4846E+05 | .4846E-01 | .6826E+00 | .3541E+03 |
| vinylacetate | .2052E+04 | .4085E-02 | .5754E-01 | .1500E+02 |
| vinylchloride | .1326E+02 | .0000E+00 | .0000E+00 | .9686E-01 |
| Ethylbenzene | .4370E+05 | .5298E-01 | .7462E+00 | .3193E+03 |

RESULTS AT TIME (DAYS) 4383.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .3282E+01 | .5644E+04 | .7529E+01 | .3629E+02 |
| toluene | .7714E+03 | .4575E+07 | .1497E+04 | .2619E+05 |
| p-xylene | .2225E+03 | .4449E+07 | .4855E+03 | .2449E+05 |
| 111-trichloroethane | .1429E+03 | .1517E+07 | .9978E+03 | .1126E+05 |
| 1122-tetrachloroethane | .6168E+03 | .1515E+08 | .1533E+05 | .1340E+06 |
| 112-trichloroethane | .2505E+02 | .1077E+06 | .2127E+03 | .2240E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |

| | | | | |
|---|---|---|---|---|
| tetrachloroethene | .2606E+02 | .1867E+07 | .9888E+02 | .1405E+04 |
| trichloroethene | .1344E+02 | .3042E+05 | .1491E+02 | .1277E+03 |
| vinylacetate | .7170E+00 | .8220E+03 | .1119E+01 | .1997E-01 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .1332E+02 | .2490E+05 | .2076E+01 | .1045E+03 |

TOTAL MASS IN ALL PHASE = .2795E+05

TOTAL MASS IN GAS PHASE (kg) = .1835E+01
TOTAL MASS IN FREE PHASE (kg) = .2773E+05
TOTAL MASS IN WATER PHASE (kg) = .1864E+02
TOTAL MASS IN SOIL PHASE (kg) = .1999E+03

| SPECIES<br>S | MASS<br>g | CONC<br>WELL GAS<br>g/m3 | CONC<br>SOIL GAS<br>g/m3 | CONC<br>SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .5691E+04 | .8135E-02 | .1146E+00 | .4159E+02 |
| toluene | .4603E+07 | .1901E+01 | .2677E+02 | .3364E+05 |
| p-xylene | .4474E+07 | .5471E+00 | .7706E+01 | .3269E+05 |
| 111-trichloroethane | .1529E+07 | .3517E+00 | .4954E+01 | .1118E+05 |
| 1122-tetrachloroethane | .1530E+08 | .1517E+01 | .2136E+02 | .1118E+06 |
| 112-trichloroethane | .1102E+06 | .6177E-01 | .8701E+00 | .8052E+03 |
| 11-dichoroethane | .3697E+02 | .0000E+00 | .0000E+00 | .2701E+00 |
| 11-dichoroethene | .1967E+02 | .0000E+00 | .0000E+00 | .1437E+00 |
| methylenechloride | .2187E+02 | .0000E+00 | .0000E+00 | .1598E+00 |
| tetrachloroethene | .1869E+07 | .6405E-01 | .9022E+00 | .1366E+05 |
| trichloroethene | .3058E+05 | .3325E-01 | .4684E+00 | .2234E+03 |
| vinylacetate | .8239E+03 | .1785E-02 | .2514E-01 | .6020E+01 |
| vinylchloride | .9330E+01 | .0000E+00 | .0000E+00 | .6818E-01 |
| Ethylbenzene | .2502E+05 | .3299E-01 | .4647E+00 | .1828E+03 |

RESULTS AT TIME (DAYS) 4748.606000

| SPECIES | ........MASS (g) IN PHASES ....<br>GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .1853E+01 | .2921E+04 | .4251E+01 | .2049E+02 |
| toluene | .6941E+03 | .3773E+07 | .1347E+04 | .2357E+05 |
| p-xylene | .2288E+03 | .4195E+07 | .4994E+03 | .2519E+05 |
| 111-trichloroethane | .1399E+03 | .1361E+07 | .9764E+03 | .1102E+05 |
| 1122-tetrachloroethane | .6410E+03 | .1443E+08 | .1593E+05 | .1393E+06 |

| | | | | |
|---|---|---|---|---|
| 112-trichloroethane | .2104E+02 | .8290E+05 | .1786E+03 | .1881E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2792E+02 | .1834E+07 | .1060E+03 | .1506E+04 |
| trichloroethene | .8877E+01 | .1841E+05 | .9842E+01 | .8433E+02 |
| vinylacetate | .2893E+00 | .3041E+03 | .4515E+00 | .8060E-02 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .7912E+01 | .1356E+05 | .1233E+01 | .6208E+02 |

TOTAL MASS IN ALL PHASE = .2594E+05

TOTAL MASS IN GAS PHASE (kg) = .1772E+01
TOTAL MASS IN FREE PHASE (kg) = .2572E+05
TOTAL MASS IN WATER PHASE (kg) = .1905E+02
TOTAL MASS IN SOIL PHASE (kg) = .2026E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| <br>g | g | g/m3 | g/m3 | mg/k |
| benzene | .2948E+04 | .4596E-02 | .6473E-01 | .2154E+02 |
| toluene | .3799E+07 | .1710E+01 | .2409E+02 | .2776E+05 |
| p-xylene | .4221E+07 | .5628E+00 | .7927E+01 | .3084E+05 |
| 111-trichloroethane | .1373E+07 | .3442E+00 | .4848E+01 | .1003E+05 |
| 1122-tetrachloroethane | .1459E+08 | .1576E+01 | .2220E+02 | .1066E+06 |
| 112-trichloroethane | .8499E+05 | .5188E-01 | .7308E+00 | .6210E+03 |
| 11-dichoroethane | .3378E+02 | .0000E+00 | .0000E+00 | .2469E+00 |
| 11-dichoroethene | .1827E+02 | .0000E+00 | .0000E+00 | .1335E+00 |
| methylenechloride | .2002E+02 | .0000E+00 | .0000E+00 | .1463E+00 |
| tetrachloroethene | .1836E+07 | .6864E-01 | .9667E+00 | .1342E+05 |
| trichloroethene | .1852E+05 | .2197E-01 | .3094E+00 | .1353E+03 |
| vinylacetate | .3048E+03 | .7211E-03 | .1016E-01 | .2227E+01 |
| vinylchloride | .9312E+01 | .0000E+00 | .0000E+00 | .6805E-01 |
| Ethylbenzene | .1363E+05 | .1961E-01 | .2762E+00 | .9959E+02 |

RESULTS AT TIME (DAYS) 5113.606000

| SPECIES | ........MASS (g) IN PHASES ....<br>GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .9883E+00 | .1423E+04 | .2267E+01 | .1093E+02 |

| | | | | |
|---|---|---|---|---|
| toluene | .6159E+03 | .3058E+07 | .1195E+04 | .2091E+05 |
| p-xylene | .2350E+03 | .3934E+07 | .5128E+03 | .2587E+05 |
| 111-trichloroethane | .1360E+03 | .1209E+07 | .9496E+03 | .1071E+05 |
| 1122-tetrachloroethane | .6656E+03 | .1369E+08 | .1654E+05 | .1447E+06 |
| 112-trichloroethane | .1731E+02 | .6231E+05 | .1470E+03 | .1548E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .2999E+02 | .1799E+07 | .1138E+03 | .1617E+04 |
| trichloroethene | .5617E+01 | .1064E+05 | .6228E+01 | .5336E+02 |
| vinylacetate | .1069E+00 | .1026E+03 | .1668E+00 | .2977E-02 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .4460E+01 | .6980E+04 | .6952E+00 | .3499E+02 |

TOTAL MASS IN ALL PHASE = .2400E+05

TOTAL MASS IN GAS PHASE (kg) = .1711E+01
TOTAL MASS IN FREE PHASE (kg) = .2377E+05
TOTAL MASS IN WATER PHASE (kg) = .1947E+02
TOTAL MASS IN SOIL PHASE (kg) = .2054E+03

| SPECIES<br>S | MASS<br>g | CONC WELL GAS<br>g/m3 | CONC SOIL GAS<br>g/m3 | CONC SOIL MAS<br>mg/k<br>g |
|---|---|---|---|---|
| benzene | .1437E+04 | .2454E-02 | .3457E-01 | .1050E+02 |
| toluene | .3080E+07 | .1518E+01 | .2138E+02 | .2251E+05 |
| p-xylene | .3960E+07 | .5781E+00 | .8142E+01 | .2894E+05 |
| 111-trichloroethane | .1221E+07 | .3348E+00 | .4716E+01 | .8919E+04 |
| 1122-tetrachloroethane | .1385E+08 | .1637E+01 | .2306E+02 | .1012E+06 |
| 112-trichloroethane | .6403E+05 | .4272E-01 | .6017E+00 | .4679E+03 |
| 11-dichoroethane | .3138E+02 | .0000E+00 | .0000E+00 | .2293E+00 |
| 11-dichoroethene | .1550E+02 | .0000E+00 | .0000E+00 | .1133E+00 |
| methylenechloride | .1816E+02 | .0000E+00 | .0000E+00 | .1327E+00 |
| tetrachloroethene | .1801E+07 | .7370E-01 | .1038E+01 | .1316E+05 |
| trichloroethene | .1071E+05 | .1391E-01 | .1960E+00 | .7823E+02 |
| vinylacetate | .1029E+03 | .2668E-03 | .3758E-02 | .7516E+00 |
| vinylchloride | .9293E+01 | .0000E+00 | .0000E+00 | .6790E-01 |
| Ethylbenzene | .7020E+04 | .1107E-01 | .1559E+00 | .5130E+02 |

RESULTS AT TIME (DAYS) 5478.606000

SPECIES ........MASS (g) IN PHASES ....

| | GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .4943E+00 | .6476E+03 | .1134E+01 | .5466E+01 |
| toluene | .5375E+03 | .2428E+07 | .1043E+04 | .1825E+05 |
| p-xylene | .2407E+03 | .3666E+07 | .5252E+03 | .2649E+05 |
| 111-trichloroethane | .1313E+03 | .1061E+07 | .9164E+03 | .1034E+05 |
| 1122-tetrachloroethane | .6902E+03 | .1292E+08 | .1715E+05 | .1500E+06 |
| 112-trichloroethane | .1392E+02 | .4559E+05 | .1182E+03 | .1245E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .3226E+02 | .1761E+07 | .1224E+03 | .1739E+04 |
| trichloroethene | .3385E+01 | .5836E+04 | .3754E+01 | .3216E+02 |
| vinylacetate | .3576E-01 | .3123E+02 | .5580E-01 | .9961E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2369E+01 | .3373E+04 | .3692E+00 | .1859E+02 |

TOTAL MASS IN ALL PHASE = .2212E+05

TOTAL MASS IN GAS PHASE (kg) = .1652E+01
TOTAL MASS IN FREE PHASE (kg) = .2189E+05
TOTAL MASS IN WATER PHASE (kg) = .1988E+02
TOTAL MASS IN SOIL PHASE (kg) = .2081E+03

| SPECIES<br>S | MASS | CONC<br>WELL GAS | CONC<br>SOIL GAS | CONC<br>SOIL MAS |
|---|---|---|---|---|
| g | g | g/m3 | g/m3 | mg/k |
| benzene | .6547E+03 | .1229E-02 | .1731E-01 | .4784E+01 |
| toluene | .2448E+07 | .1326E+01 | .1868E+02 | .1789E+05 |
| p-xylene | .3694E+07 | .5923E+00 | .8342E+01 | .2699E+05 |
| 111-trichloroethane | .1073E+07 | .3233E+00 | .4554E+01 | .7840E+04 |
| 1122-tetrachloroethane | .1309E+08 | .1698E+01 | .2392E+02 | .9562E+05 |
| 112-trichloroethane | .4698E+05 | .3439E-01 | .4843E+00 | .3433E+03 |
| 11-dichoroethane | .2819E+02 | .0000E+00 | .0000E+00 | .2060E+00 |
| 11-dichoroethene | .1410E+02 | .0000E+00 | .0000E+00 | .1030E+00 |
| methylenechloride | .1631E+02 | .0000E+00 | .0000E+00 | .1192E+00 |
| tetrachloroethene | .1763E+07 | .7936E-01 | .1118E+01 | .1288E+05 |
| trichloroethene | .5875E+04 | .8396E-02 | .1183E+00 | .4293E+02 |
| vinylacetate | .3132E+02 | .8943E-04 | .1260E-02 | .2289E+00 |
| vinylchloride | .9272E+01 | .0000E+00 | .0000E+00 | .6775E-01 |
| Ethylbenzene | .3395E+04 | .5886E-02 | .8290E-01 | .2481E+02 |

RESULTS AT TIME (DAYS) 5478.606000

| SPECIES | ........MASS (g) IN PHASES .... GAS | OIL | WATER | SOLID |
|---|---|---|---|---|
| benzene | .4943E+00 | .6476E+03 | .1134E+01 | .5466E+01 |
| toluene | .5375E+03 | .2428E+07 | .1043E+04 | .1825E+05 |
| p-xylene | .2407E+03 | .3666E+07 | .5252E+03 | .2649E+05 |
| 111-trichloroethane | .1313E+03 | .1061E+07 | .9164E+03 | .1034E+05 |
| 1122-tetrachloroethane | .6902E+03 | .1292E+08 | .1715E+05 | .1500E+06 |
| 112-trichloroethane | .1392E+02 | .4559E+05 | .1182E+03 | .1245E+04 |
| 11-dichoroethane | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| 11-dichoroethene | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| methylenechloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| tetrachloroethene | .3226E+02 | .1761E+07 | .1224E+03 | .1739E+04 |
| trichloroethene | .3385E+01 | .5836E+04 | .3754E+01 | .3216E+02 |
| vinylacetate | .3576E-01 | .3123E+02 | .5580E-01 | .9961E-03 |
| vinylchloride | .0000E+00 | .0000E+00 | .0000E+00 | .0000E+00 |
| Ethylbenzene | .2369E+01 | .3373E+04 | .3692E+00 | .1859E+02 |

TOTAL MASS IN ALL PHASE = .2212E+05

TOTAL MASS IN GAS PHASE (kg) = .1652E+01
TOTAL MASS IN FREE PHASE (kg) = .2189E+05
TOTAL MASS IN WATER PHASE (kg) = .1988E+02
TOTAL MASS IN SOIL PHASE (kg) = .2081E+03

| SPECIES S | MASS g | CONC WELL GAS g/m3 | CONC SOIL GAS g/m3 | CONC SOIL MAS mg/k g |
|---|---|---|---|---|
| benzene | .6547E+03 | .1229E-02 | .1731E-01 | .4784E+01 |
| toluene | .2448E+07 | .1326E+01 | .1868E+02 | .1789E+05 |
| p-xylene | .3694E+07 | .5923E+00 | .8342E+01 | .2699E+05 |
| 111-trichloroethane | .1073E+07 | .3233E+00 | .4554E+01 | .7840E+04 |
| 1122-tetrachloroethane | .1309E+08 | .1698E+01 | .2392E+02 | .9562E+05 |
| 112-trichloroethane | .4698E+05 | .3439E-01 | .4843E+00 | .3433E+03 |
| 11-dichoroethane | .2819E+02 | .0000E+00 | .0000E+00 | .2060E+00 |
| 11-dichoroethene | .1410E+02 | .0000E+00 | .0000E+00 | .1030E+00 |
| methylenechloride | .1631E+02 | .0000E+00 | .0000E+00 | .1192E+00 |
| tetrachloroethene | .1763E+07 | .7936E-01 | .1118E+01 | .1288E+05 |
| trichloroethene | .5875E+04 | .8396E-02 | .1183E+00 | .4293E+02 |
| vinylacetate | .3132E+02 | .8943E-04 | .1260E-02 | .2289E+00 |

| | | | | |
|---|---|---|---|---|
| vinylchloride | .9272E+01 | .0000E+00 | .0000E+00 | .6775E-01 |
| Ethylbenzene | .3395E+04 | .5886E-02 | .8290E-01 | .2481E+02 |

# Appendix C – Dewatering Calculations

## ACS: Dewatering Project

Cap design scenarios during dewatering:
Onsite Area, Scenario 1: Existing conditions
Onsite Area, Scenario 2: Regrade to drain
Onsite Area, Scenario 3: regrade and 1' clay cap
Onsite Area, Scenario 4: regrade, clay cap with paved areas
Offsite Area: Capped with 1' clay

Dewatering project design criteria:

1. Still bottoms area needs to be dewatered within one year.
2. System used to treat water removed during the dewatering operation can handle a maximum flow of 35 gpm.
3. Each pump within the trenches has a maximum pumping rate of 5 gpm.
4. 90% pump efficiency

Dewatering Options:
Option 1 = use existing trenches
Option 2 = use existing trenches, install separation barrier
Option 3 = use existing trenches, install separation barrier, put in place well point system
Option 4 = use existing trenches, install separation barrier, put in place well point system, surround well points with sheet pile

| | Onsite Area Scenario 1 | Onsite Area Scenario 2 | Onsite Area Scenario 3 | Onsite Area Scenario 4 | Capped Offsite Area | Area Enclosed in Sheetpile |
|---|---|---|---|---|---|---|
| **Option 1** | 1.1 yr / 35 gpm | 1.1 yr / 35 gpm | 1.0 yr / 35 gpm | 1.0 yr / 35 gpm | | |
| **Option 2** | 0.55 yrs / 35 gpm | 0.54 yrs / 35 gpm | 0.50 yrs / 35 gpm | 0.44 yrs / 35 gpm | 0.63 yrs / 25gpm | |
| **Option 3** | 1.0 yrs / 22.2 gpm | 1.0 yrs / 21.7 gpm | 1.0 yrs / 19.6 gpm | 1.0 yrs / 17.5 gpm | | |
| **Option 4** | 1.2 yrs / 15 gpm | 1.2 yrs / 15 gpm | 1.1 yrs / 15 gpm | 0.9 yrs / 15 gpm | | 1.0 yrs / 9.26 gpm |

**Summary of dewatering options:**

**Option 1**: The entire site can be dewatered in one year if the Onsite Area is capped with clay beneath the gravel or if it is capped with clay and asphalt.
**Option 2**: By separating the offsite and onsite areas with a separation barrier, they can be dewatered separately. The offsite area can be dewatered in 0.63 years with the five trenches already in place. Then, the hydraulic capacity of the system can be devoted to dewatering the onsite area. The onsite area can be dewatered in approximately half a year under all scenarios.
**Option 3**: The dewatering of the Onsite Area under this option is achievable within a year under all four capping scenarios.
**Option 4**: The Still Bottoms Pond Area can be dewatered in one year with the well points operated at a pumping rate of 10.41 gpm. The area within the sheet pile could be dewatered faster than one year however the treatment system would not handle the flow hydraulically or chemically. The rest of the Onsite Area can only be dewatered within a year if capping scenario 4 is chosen.

MONTGOMERY WATSON

BY APE DATE 6/29/98 CLIENT ACS SHEET 1 OF
CHKD. BY DESCRIPTION JOB NO.

Problem: Need to determine the infiltration to the ACS site and need to determine the time required to dewater the site by removing the current quantity of water existing at the site in addition to the infiltration.

Design Criteria:
- Still bottoms area needs to be dewatered within a one year time period.
- the system which will be used to treat water removed during the dewatering operation can only handle a total flow of 35 gpm.

References:

1. Dodson, R.D., 1995. Storm Water Pollution Control: Industry and Construction NPDES Compliance, McGraw-Hill, Inc., New York.
   - this reference was used to obtain the runoff coefficient for asphalt and the Rational Method in order to determine runoff from Colfax Rd.
2. Montgomery Watson, 1996. American Chemical Services, Inc. NPL Site Draft Perimeter Groundwater Containment System, 100 percent design submittal, February.
   - this reference was used to obtain site specific hydrogeological parameters.
3. Environmental Laboratory, USAE Waterways Experiment Station, 1994. Hydrologic Evaluation of Landfill Performance (HELP) Model, version 3.01, 10 October.
   - this computer model was used to obtain data on precipitation, evapotranspiration, temperature, solar radiation, and soil layer design. Based on synthetic weather data from the nearby location of Chicago, IL and on the soil layer design data average annual amounts of infiltration, evapotranspiration, and runoff were determined.
4. Holtz, R.D. and W.D. Kovacs, 1981. An Introduction to Geotechnical Engineering, Prentice-Hall Civil Engineering and Engineering Mechanics Series.
   - this reference, in addition to consulting with T. Blair was used to determine the porosity of the water bearing layer.

EN 1S (10/78)

MONTGOMERY WATSON

BY APE DATE 6/29/98 CLIENT ACS SHEET 2 OF

CHKD. BY DESCRIPTION JOB NO.

Given: · ACS site layout: Porosity data from reference #4 and interview of T. Blair
Water table data from June 1998 Quarterly Groundwater measurements.

| | Offsite Area | Onsite Area | Still bottoms Area | Sheetpile Area |
|---|---|---|---|---|
| Current Depth of water table: | 10 ft | 5 ft | 5 ft | 5 ft |
| Desired depth of water table: | 15 ft | 10 ft | 10 ft | 10 ft |
| Depth to clay layer: | 25 ft | 20 ft | 20 ft | 20 ft |
| Porosity of Water Bearing layer: (reference #4 and interview T. Blair.) | 0.35 | 0.3 | 0.3 | 0.3 |
| Area: (1acre = 43,560 $ft^2$) | 13 acres<br>566,280 $ft^2$ | 15 acres<br>653,440 $ft^2$ | 3.3 acres<br>143,748 $ft^2$ | 3.44 acres<br>150,000 $ft^2$ |

Step 1: Determine existing volume of water in each area. This will be determined with the following formula:

$$\text{Volume of Water} = \left[\begin{matrix}\text{Desired depth of}\\ \text{water table}\end{matrix} - \begin{matrix}\text{Current depth}\\ \text{of water table}\end{matrix}\right] \times \text{Area} \times \text{Porosity} \qquad (1 ft^3 = 7.48 \text{ gallons})$$

So, for the offsite area,

$$V_{offsite} = [15 ft - 10 ft] \times 566,280 ft^2 \times 0.35 = 990,990 ft^3 = \boxed{7,412,600 \text{ gallons}}$$

$$V_{onsite} = [10' - 5'] \times 633,440 ft^2 \times 0.30 = 480,160 ft^3 = \boxed{7,331,600 \text{ gallons}}$$

$$V_{still\ bottoms} = [10' - 5'] \times 143,748 ft^2 \times 0.30 = 215,612 ft^3 = \boxed{1,612,850 \text{ gallons}}$$

$$V_{sheetpile} = [10' - 5'] \times 150,000 ft^2 \times 0.30 = 225,000 ft^3 = \boxed{1,683,000 \text{ gallons}}$$

Step 2: Determine runoff from Colfax Road which drains onto site. Use Rational Method from Reference #1

$$Q = CIA$$

where: C = runoff coefficient, determined by land use

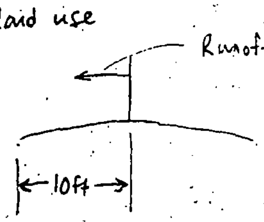
$C(\text{asphalt}) = 0.7 - 0.95$

assume $C = 0.80$

A = drainage Area, $ft^2$

I = rainfall intensity, in/yr

$I = 34.15 \text{ inches/yr}$ (Avg. Annual Precipitation) from reference 3.




800 ft of road along onsite area and 800 ft of road along offsite area drain onto the respective areas.

$$A = (800 ft)(10 ft) = 8000 ft^2$$

$$Q = (0.8)\left(\frac{34.15 \text{ in/yr}}{12 \text{ in/ft}}\right)(8000 ft^2)$$

$$Q = 18,213 ft^3/yr$$

$$\boxed{Q = 136,136 \text{ gallons/yr.}}$$

EN 1S (10/78)

Step 3 Determine the quantity of infiltration to each of the areas in ACS. Primarily we are interested in infiltration to 3 areas:

- still bottoms area
- 'other' onsite infiltration
- offsite area

The still bottoms area and the offsite area will both be capped with clay and so this will be the only soil design modeled using the HELP model. The remaining on-site area will be looked at under four different scenarios. These scenarios are listed below.

Scenario 1: remaining onsite area as it exists. 70% of surface allows runoff. — 12" gravel over top 18" silty sand

Scenario 2: remaining onsite area regraded so the surface allows 100% runoff. — 12" gravel over top 18" silty sand

Scenario 3: remaining onsite area regraded so the surface allows 100% runoff and clay cap put beneath gravel. — 12" gravel over 12" clay over 18" silty sand

Scenario 4: 70% of remaining onsite area is capped with topsoil over the cap that has a good stand of grass. Other 30% of area is paved with asphalt to allow for ACS operations.

- 70%: 6" topsoil w/ grass, 12" clay
- 30%: 6" asphalt, 12" gravel

The infiltration will be determined for the capped still bottoms area, then the 4 scenarios for the remaining onsite area, and then for the offsite area. All of the values presented are outputs from the HELP Model which is reference 3. The values generated by the HELP Model represent the Average Annual Totals for years 1 through 100. The HELP model file for each run is written in parentheses along with the page

Capped Still bottoms area (HELP Model filename: Stillbot.out, pg. 6)

$$\text{Infiltration} = 134\ ft^3/yr \times \frac{7.48\ gallons}{1\ ft^3} = \boxed{1{,}002\ gallons/yr} \times \frac{1\ yr}{365\ days} \times \frac{1\ day}{24\ hours} \times \frac{1\ hours}{60\ min} = \boxed{0.002\ gallons/min.}$$

Runoff from the capped still bottoms area will also be determined because this runoff will infiltrate into other areas within the onsite area.

$$\text{Runoff} = 301{,}729\ ft^3/yr = 2{,}256{,}933\ gallons/yr$$

Note: Contributions from the fire pond leakage into the subsurface will be neglected because the fire pond shall be emptied and filled with concrete.

**MONTGOMERY WATSON**

BY ADE DATE 6/29/98 CLIENT ACS SHEET 4 OF
CHKD. BY DESCRIPTION JOB NO.

Remaining On-site Area : Scenario 1 : remaining onsite area as it exists. 12" gravel over top 18" silty sand 70% of surface allows runoff.

(HELP Model filename: Onsite.out, page 6)

The Direct infiltration to the onsite area will be determined first with the HELP model output. Then the infiltration coming from runoff which drains onto the onsite area from Colfax Road and from the capped still bottoms area will be calculated. Of this runoff which drains to the site a certain percentage of it will evaporate and of the remaining quantity a certain percentage will be assumed to infiltrate. Based on the cap designs and on weather and evapotranspiration factors, these percentages are determined by the HELP model. First we will determine direct infiltration.

Direct Infiltration = ~~704,197~~ 390,795 ft³/yr = $\boxed{\text{~~5,267,393~~ 2,923,147 gallons/yr}}$

Now, the infiltration occuring due to runoff from other areas flowing into the onsite area will be determined.

Runoff from Colfax Rd. = 136,136 gallons/yr from page 2.
Runoff from still bottoms area = 2,256,933 gallons/yr from page 3.

Total Runoff to onsite area = 2,393,069 gallons/yr

As can be seen in the HELP file - Onsite.out, page 6 - ~~45.5~~ 63.1 % of the water entering the onsite area is lost to evapotranspiration. Therefore, ~~45.5~~ 63.1 % of the total runoff to the onsite area will be lost to evapotranspiration and ~~54.5~~ 36.9 % will remain behind. As can also be seen in the HELP file, ~~48.5~~ 26.9 % of water on the site percolates through layer 2. It is therefore assumed that ~~48.5~~ 26.9 % of the ~~54.5~~ 36.9 % of the total runoff remaining will infiltrate.

Additional runoff infiltration = [2,393,933 gallons/yr − (~~45.5%~~ 63.1 %)(2,393,933 gal/yr)] (~~48.5%~~ 26.9)

= $\boxed{\text{~~632,776~~ 237,624 gallons/yr}}$

The total infiltration to the onsite area will be the sum of the direct infiltration and the additional runoff infiltration.

Total Infiltration = ~~5,267,393~~ 2,923,147 gal/yr + ~~632,776~~ 237,624 gal/yr = $\boxed{\text{~~5,900,159~~ gal/yr = ~~11.22~~ gal/min}}$

3,160,771 gal/yr = 6.01 gal/min

MONTGOMERY WATSON

BY APE DATE 6/29/98 CLIENT ACS SHEET 5 OF

CHKD. BY DESCRIPTION JOB NO.

Remaining On-Site Area : Scenario 2 remaining on-site area regraded to allow 100% runoff:

(HELP Model file: Onsite3.out, page 6) First, find the infiltration

Direct Infiltration = ~~688,478~~ 360,942 ft³/yr = $\boxed{\text{~~5,149,815~~ 2,699,846 gal/yr}}$

From the summation of runoff contributions to the onsite area on page 4 we know the total runoff to the onsite area. – Total Runoff to on-site area: 2,393,064 gal/yr.

~~45~~ 62.0 % of the water entering the onsite area in scenario 2 is lost to evapotranspiration. Of the ~~55~~ 38 % remaining it is assumed that ~~47.5~~ 25.0 % will infiltrate, because the percentage of water infiltrating the site is ~~47.5~~ % 25.0 62%

additional runoff infiltration = [2,393,064 gal/yr − (~~45%~~)(2,393,064 gal/yr)](~~47.5%~~ 25.0)

= $\boxed{\text{~~625,188~~ gal/yr}}$ 227,341 gal/yr

Total infiltration = ~~5,149,815~~ 2,699,846 gal/yr + ~~625,188~~ 227,341 gal/yr = $\boxed{\text{~~5,775,000~~ gal/yr = ~~10.99~~ gal/min}}$ 2,927,187 gal/yr 5.57 gal/min

Remaining On-Site Area: Scenario 3 : remaining onsite area regraded to allow 100% runoff and with a 12" clay layer beneath 12" of gravel,

(HELP Model file: Onsite 5.out, pg. 6)

Direct Infiltration: ~~262,769~~ 241,392 ft³/yr = $\boxed{\text{~~1,965,512~~ 1,805,612 gal/yr}}$

The summation of total runoff contributions to the onsite area on page for yields:

Total runoff to onsite area: 2,393,064 gal/yr.

64% of the water entering the onsite area in scenario 3 is lost to evapotranspiration. Of the 36% remaining it is assumed that ~~18~~ 17 % of it shall infiltrate because this is the percentage of water which infiltrates the soil.

additional runoff infiltration = [2,393,064 gal/yr − (2,393,064 gal/yr)(64%)](~~18%~~ 17)

= $\boxed{\text{~~155,070~~ gal/yr}}$ 146,456 gal/yr

Total infiltration = ~~1,965,512~~ 1,805,612 gal/yr + ~~155,070~~ 146,456 gal/yr = $\boxed{\text{~~2,120,582~~ gal/yr = ~~4.03~~ gal/min}}$ 1,952,068 3.71 gpm

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MONTGOMERY WATSON

BY APE DATE 6/29/98 CLIENT ACS SHEET 6 OF

CHKD. BY DESCRIPTION JOB NO.

<u>Remaining On Site Area; Scenario 4</u> : capping of 70% of the remaining onsite area with 12" clay beneath 6" topsoil with a good stand of grass and paving of the remaining 30% of the onsite area. 100% runoff allowed.

(HELP Model file: Cap On 2.out, pg. 6)
(HELP Model file: Asphalt.out, pg. 6)

The paved area was modeled as though it was 6" clay overlying 12" of gravel.

Direct infiltration through the paved area = ~~128~~ 139 $ft^3/yr$ = ~~957~~ 1040 gal/yr.

Runoff from paved area = 322,185 $ft^3/yr$ = 2,409,944 gal/yr. This runoff goes into the capped grassy area

Direct infiltration through capped grassy area = 1588 $ft^3/yr$ = 11,878 gal/yr. 12,918

Total Direct Infiltration = $\boxed{\cancel{12,835} \text{ gal/yr}}$

The total runoff into the capped grassy area which contributes to the additional runoff infiltration will be runoff from Colfax Rd., runoff from the capped still bottoms area, and runoff from the paved area.

Total runoff to the onsite area = 2,393,064 gal/yr + 2,409,944 gal/yr = 4,803,000 gal/y

summation from page 4

Assume that all runoff ends up in the capped grassy area.

From HELP File: cap on 2.out, page 6, Evapotranspiration accounts for 73% of the water lost from the site. Of the remaining 27% it will be assumed that only 0.15% infiltrates as that is the quantity of water shown to infiltrate in the HELP file.

additional runoff infiltration = [4,803,000 gal/yr − (73%)(4,803,000 g/yr)](0.15%)

= $\boxed{1,945 \text{ gal/yr}}$

Total infiltration = ~~12,835~~ 12,918 gal/yr + 1,945 gal/yr = $\boxed{\cancel{14,780} \; 14,863 \text{ gal/yr} = 0.028 \text{ gal/min}}$

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MONTGOMERY WATSON

BY APE DATE 6/29/98 CLIENT ACS SHEET 7 OF

CHKD. BY DESCRIPTION JOB NO.

Conclusions: The infiltration rates, according to the HELP Model, to the capped still bottoms area and the offsite area are acceptable with the intended cap design.

Still bottoms ~~Area~~ cap = (3 layers)

12" clay $k = 5.0 \times 10^{-7}$ cm/sec where: k = hydraulic conductivity in cm/sec.

12" gravel $K = 0.3$ cm/sec

18" silty sand $K = 7.2 \times 10^{-2}$ cm/sec.

evaporative zone depth is 18"

Offsite area cap = (2 layers)

12" clay $k = 5.0 \times 10^{-7}$ cm/sec

18" silty sand $k = 7.2 \times 10^{-2}$

evaporative zone depth is 18"

The infiltration rates to the remaining on site areas are poor in Scenarios 1 and 2. The reason for this is because of the high hydraulic conductivity of the gravel and silty sand and the fact that the evaporative zone depth is only 6". In Scenario 3 the infiltration rate is fair because of the clay layer underlying the gravel. Scenario 4 is the best option because the clay on top with grass increases the evaporative zone depth to 18" and increases the quantity of water lost to evapotranspiration. Also, the asphalt and clay layers are both less permeable to water and help to reduce the quantity of infiltration.

"other" on-site areas

Scenario 1 — depressions only allow 70% runoff

12" gravel $k = 0.3$ cm/sec

18" silty sand $k = 7.2 \times 10^{-2}$

Scenario 2 — regrading allows 100% runoff

12" gravel $k = 0.3$ cm/sec

18" silty sand $k = 7.2 \times 10^{-2}$

Scenario 3

12" gravel $k = 0.3$ cm/sec

12" clay $k = 5.0 \times 10^{-7}$ cm/sec

18" silty sand $k = 7.2 \times 10^{-2}$

Scenario 4

0% — 12" clay $k = 5.0 \times 10^{-7}$ cm/sec

**MONTGOMERY WATSON**

BY APE DATE 6/29/98 CLIENT ACS SHEET 8 OF
CHKD. BY DESCRIPTION JOB NO.

Infiltration to Offsite Area : offsite area is capped with 12" clay over top of 18" silty sand.

(HELP Model file: offsite 2.out, pg. 6)

Direct Infiltration = 293 $ft^3$/yr. = $\boxed{2{,}192 \text{ gal/yr}}$

Runoff from Colfax Road is the only other major contribution of water to the site.

Total Runoff to site = 136,13.6 gal/yr (from page 2)

26% of the water entering the site is lost to evapotranspiration. 74% of the runoff from Colfax Road will come onto the site where 0.018 % of it shall infiltrate.

additional runoff infiltration = [136,136 gal/yr − (26%)(136,136 gal/yr)] (0.018%)

= $\boxed{18 \text{ gal/yr}}$ This seems unrealistic

Total infiltration = $\boxed{2{,}210 \text{ gal/yr} = 0.0042 \text{ gal/min}}$

Step 4 Summarize infiltration rates. We are interested in the infiltration to:

- the capped still bottoms area
- the "other" onsite area (4 scenarios)
- offsite area

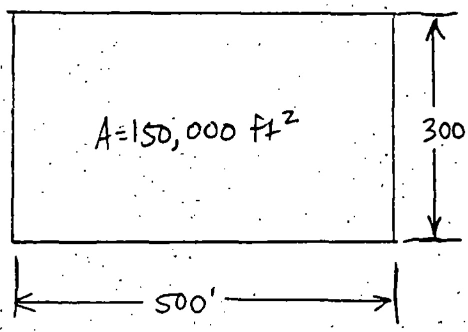
| Area | infiltration rate |
|---|---|
| capped still bottoms area | 1002 gal/yr = 0.002 gal/min |
| "other" onsite areas | |
| Scenario 1 | 5,900,159 gal/yr = 11.22 gal/min |
| Scenario 2 | 5,775,000 gal/yr = 10.99 gal/min |
| Scenario 3 | 2,120,582 gal/yr = 4.03 gal/min |
| Scenario 4 | 14,780 gal/yr = 0.028 gal/min |
| offsite | 2,210 gal/yr = 0.0042 gal/min |

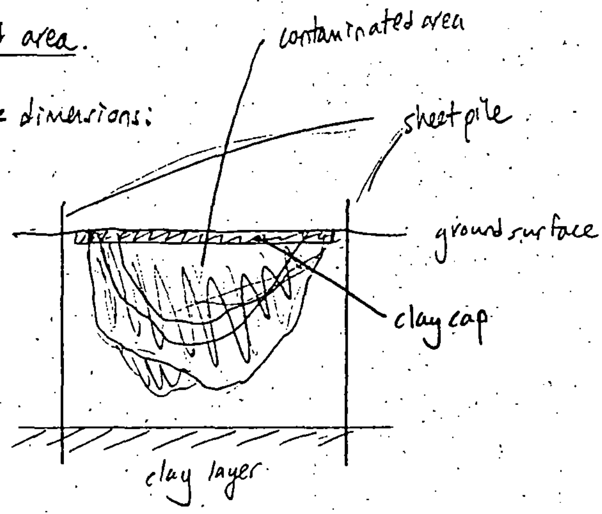
★ These infiltration rates also represent the pumping rate needed to offset infiltration.

EN 1S (10/78)

Determine the infiltration to the sheet pile enclosed area.

The sheet pile enclosed area has the following basic dimensions:




As can be seen in the above sketch, the sections of sheet pile will project above the ground surface effectively preventing any runoff. A certain percentage of precipitation will be lost to evaporation. The rest shall be assumed to infiltrate.

(HELP Model filename: Stillbot.out, pg. 6)

Precipitation = 34.15 inches

Evapotranspiration = 8.95 inches

Precipitation (inches) − Evapotranspiration (inches) = Infiltration (inches)

$$\frac{\text{Infiltration (inches)}}{12} \times \text{Area of sheet pile enclosed area } (ft^2) = ft^3 \text{ of infiltrat}$$

$$\text{Infiltration} = 34.15'' - 8.95'' = 25.20'' \times \frac{1\,ft}{12''} = \underline{2.1\ ft}$$

$$\text{Infiltration} = 2.1\,ft \times 150{,}000\,ft^2 = 315{,}000\,ft^3 = 2{,}356{,}200 \text{ gallons/yr} = \boxed{4.48 \text{ gal/min}}$$

Assume 5% of water located outside of sheet pile enclosed area will leak through the sheetpile.

Volume of water outside sheetpile = Volume of water onsite − Volume of water inside sheetpile

Reference pg. 2 for volumes

Volume outside = 7,331,600 gallons − 1,683,000 gallons = 5,648,600 gallons

$$\text{Leakage} = (5\%)(5{,}648{,}000 \text{ gallons}) = 282{,}430 \text{ gallons/yr} = \boxed{0.54 \text{ gallons/min}}$$

Also, assume approximately 1% of precipitation which infiltrates the remaining onsite area will leak through the sheetpile. At most this will be $= (11.22 \text{ gal/min})(1\%) = \boxed{0.11 \text{ gal/min}}$

**MONTGOMERY WATSON**

BY APE DATE 6/24/98 CLIENT ACS SHEET 10 OF

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Total infiltration to the sheetpile enclosed area = 4.48 gal/min + 0.54 gal/min + 0.11 gal/min

= $\boxed{5.13 \text{ gal/min}}$ = 2,696,328 gal/yr

This seems a bit high for an area capped mostly with clay. The infiltration rate to the capped still bottoms area was only 6,002 gal/yr. Because the sheetpile prevents any runoff from escaping the entire quantity of water which is not lost to evaporation is assumed to infiltrate.

☆ Run the HELP Model for the sheetpile area assuming it is entirely capped with clay and that it allows 0% runoff.

MONTGOMERY WATSON

BY APE DATE 6/29/98 CLIENT ACS SHEET 11 OF

CHKD. BY DESCRIPTION JOB NO.

## Step 5: Determine time required to dewater ACS site.

There will be six different options for dewatering the ACS site which will be investigated. These options are described below.

Option 1: Use 8 existing trenches within the ACS site each pumping at 4.38 gpm to dewater the entire site at a the design criteria rate of 35 gpm.

Option 2: Put in a separation barrier between the onsite and offsite areas and dewater each area separately using only their respective trenches operated at 5 gpm each.

Option 3: Put in a separation barrier and pump the onsite area with 3 trenches at 5 gpm each and place a well point system around the contaminated still bottoms area to increase the dewatering rate.

Option 4: Put in a separation barrier between onsite and offsite areas and install sheet pile to enclose the contaminated area. Then put in a well point system inside the sheet pile enclosed area and dewater the enclosed area with well points and the outside area with 3 trenches.

Option 5: Install the sheet pile with the well points inside and also operate the 8 trenches to dewater the entire site outside the sheet pile. Do not install a separation barrier.

Option 6: Dewater the entire ACS site using a well point system installed around the contaminated still bottoms area.

* Assume 80% efficiency for all trenches and well point systems.

Option 1 Use the 8 existing trenches operating at the design criteria flow of 35 gpm. First the entire volume of existing water on the site must be found.

Total Volume of preexisting water in entire site = $V_{onsite} + V_{offsite}$ (see page 2 for Volumes)

$$V_{total} = 7{,}331{,}600 \text{ gal} + 7{,}412{,}600 \text{ gal} = \boxed{14{,}744{,}200 \text{ gal}}$$

$\boxed{\text{At } 80\% \text{ efficiency} - 35 \text{ gpm} \times \cancel{0.80}^{\,0.90} = \cancel{28 \text{ gpm}}}$ 31.5 gpm

The infiltration to the site will vary depending upon which onsite capping scenario is chosen. Consult page 8 to see infiltration rates ~~for~~ the different options.

Scenario 1 total infiltration to site = still bottoms + "other" onsite area + offsite area

$= 0.002 \text{ gal/min} + \cancel{11.22}\ 6.01 \text{ gal/min} + 0.004 \text{ gal/min}$

12" gravel w/ only 70% runoff.

$= \cancel{11.23 \text{ gal/min}}$

6.02 gal/min

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MONTGOMERY WATSON

BY APE DATE 6/29/99 CLIENT ACS SHEET 12 OF

CHKD. BY DESCRIPTION JOB NO.

Option 1
(scenario 1, cont.)

total infiltration to site = 11.23 gal/min

This infiltration will try to fill the site with water as the dewatering project attempts to dewater the site. Since they oppose each other, the infiltration rate will be subtracted from the pumping rate to get the adjusted pumping rate.

$$\boxed{\text{Pumping Rate} - \text{Infiltration rate} = \text{adjusted pumping rate}}$$

$$\boxed{\frac{V_{total}}{\text{adjusted pumping rate}} = \text{time to dewater.}}$$

$$\text{time to dewater} = \frac{14,744,200 \text{ gal}}{(\cancel{28}_{31.5} \text{ gpm} - \cancel{11.23}_{6.02} \text{ gpm})} = \boxed{\cancel{1.67} \text{ years}} \quad 1.10 \text{ years}$$

→ to dewater site in 1 year pumping rate required would be:

$14,744,200$ gal/yr = 28 gpm + infiltration rate
= 39.23 gpm / 0.80 = 49.04 gpm this exceeds the design criteria.

---

Scenario 2 12" gravel regraded to allow 100% runoff in the on site area.

$$\text{total infiltration to site} = 0.002 \text{ gal/min} + \cancel{10.99}_{5.57} \text{ gal/min} + 0.004 \text{ gal/min}$$

$$= \cancel{11.00 \text{ gal/min}} \quad 5.58 \text{ gpm}$$

$$\text{time to dewater} = \frac{14,744,200 \text{ gal}}{(\cancel{28}_{31.5} \text{ gpm} - \cancel{11}_{5.58} \text{ gpm})} = \boxed{\cancel{1.65} \text{ years}} \quad 1.08 \text{ yrs}$$

the pumping rate required to dewater the site within 1 year would exceed the design criteria.

---

Scenario 3 12" gravel regraded to allow 100% runoff and the installation of a 12" clay layer beneath the gravel.

$$\text{total infiltration to site} = 0.002 \text{ gpm} + \cancel{4.03}_{3.71} \text{ gpm} + 0.004 \text{ gpm}$$

$$= \cancel{4.04} \text{ gpm} \quad 3.72$$

$$\text{time to dewater} = \frac{14,744,200 \text{ gal}}{(\cancel{28}_{31.5} \text{ gpm} - \cancel{4.04}_{3.72} \text{ gpm})} = \boxed{\cancel{1.17} \text{ years}} \quad 1.01$$

---

Scenario 4 70% of remaining onsite area capped w/12" clay beneath 6" topsoil with a good stand of grass and the remaining 30% of the onsite area paved with asphalt.

$$\text{total infiltration to site} = 0.002 \text{ gpm} + 0.028 \text{ gpm} + 0.004 \text{ gpm}$$

$$= 0.034 \text{ gpm}$$

$$\text{time to dewater} = \frac{14,744,200 \text{ gal}}{28 \text{ gpm} - 0.034 \text{ gpm}} = \boxed{1.00 \text{ years}}$$

**Option 1** — Conclusion: It will be impossible to dewater the entire site within 1 year at a pumping rate that does not exceed 35 gpm in Scenario's one through three. In the fourth scenario the site can be dewatered in exactly one year.
← Costly, Not likely to be done in 1yr.

∴ ★ Option 1 for dewatering the entire ACS site is not a viable option.

---

**Option 2** Install a separation barrier between the onsite and offsite areas and dewater each separately using the trenches.

**Onsite Area** - the onsite area infiltration rate will vary depending upon the capping scenario chosen.
Infiltration rate data on pg. 8.

Total volume preexisting water in onsite area = 7,331,600 gal.

3 trenches:
Max pumping rate = 15 gpm

$(15\,gpm)\,\cancel{0.80}\ 0.90 = \cancel{12}\ gpm = 13.5\ gpm$

**Scenario 1** (12" gravel w/ 70% allowing runoff.)

total infiltration to onsite area = 0.002 gpm + $\cancel{11.22}$ 6.01 gpm
= $\cancel{11.22}$ 6.01 gpm

$$\text{time to dewater} = \frac{7{,}331{,}600\ gal.}{\cancel{12}\ 13.5\ gpm - \cancel{11.22}\ 6.01\ gpm} = \boxed{\cancel{17.88}\ years}\ 1.86$$

✓

---

**Scenario 2** · regrading of gravel to allow 100% runoff.

total infiltration = 0.002 gpm + $\cancel{10.99}$ 5.57 ppm
= $\cancel{10.99}$ 5.57 gpm

$$\text{time to dewater} = \frac{7{,}331{,}600\ gal}{\cancel{12}\ 13.5\ gpm - \cancel{10.99}\ 5.57\ gpm} = \boxed{\cancel{13.81}\ years}\ 1.76\ years$$

✓

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**Scenario 3** · regrading of gravel to allow 100% runoff and place 12" clay layer beneath gravel.

total infiltration = 0.002 gpm + $\cancel{4.03}$ 3.71 gpm
= $\cancel{4.03}$ 3.71 gpm

$$\text{time to dewater} = \frac{7{,}331{,}600\ gal.}{\cancel{12}\ 13.5\ gpm - \cancel{4.03}\ 3.71\ gpm} = \boxed{\cancel{1.75}\ years}\ 1.42\ yrs$$

✓

MONTGOMERY WATSON

BY APE DATE 6/29/98 CLIENT ACS SHEET 14 OF

CHKD. BY DESCRIPTION JOB NO.

Option 2 (cont.)

Onsite Area

Scenario 4 - capping of 70% of onsite w/clay and grass and paving of 30% of site.

$$\text{total infiltration} = 0.002\text{ gpm} + 0.028\text{ gpm} = \underline{0.03\text{ gpm}}$$

$$\text{time to dewater} = \frac{7{,}331{,}600\text{ gal}}{\cancel{12}\,13.5\text{ gpm} - 0.03\text{ gpm}} = \boxed{1.16\text{ years}}$$

Offsite Area The offsite area is capped with 12" clay overtop 18" siltysand. There are 5 trenches which could pump at a maximum rate of 25 gpm. $25\text{ gpm} \times \cancel{0.80}\,0.90 = \cancel{20\text{ gpm}}\,22.5\text{ gpm}$

from pg. 2.

Total volume preexisting water in offsite area = 7,412,600 gallons

total infiltration to offsite area = 0.0042 gpm — from pg. 8

$$\text{time to dewatered} = \frac{7{,}412{,}600\text{ gal}}{\cancel{20}\,22.5\text{ gpm} - 0.0042\text{ gpm}} = \boxed{\cancel{0.71}\text{ years}}$$

0.63 years

pumping rate required to dewater offsite area in 1 yr..

$$\frac{7{,}412{,}600\text{ gal}}{1\text{ yr}} = 14.10\text{ gpm}/0.80 = \underline{17.63\text{ gpm}} + \cancel{\text{infiltration}}$$

negligible.

Option 2 Conclusion

The onsite area can not be dewatered within one year with only 3 trenches with a maximum pumping capacity of 15 gpm.

The offsite area can be dewatered in less than one year at the maximum pumping rate of 25 gpm. At a pumping rate of 17.63 gpm the offsite area can be dewatered in one year.

EN. 1S (10/78)

Option 3 — dewater the onsite area with well point system around still bottoms area and 3 trenches within onsite area.

Total Volume to be removed within 1 yr = existing water + 1 yr of infiltration.

existing volume of water in onsite area = $\boxed{7{,}331{,}600 \text{ gallons}}$ (from pg. 2)

The infiltration to the capped still bottoms area is 1,002 gal/yr.

The infiltration to the remaining onsite areas varies with the capping scenario. The total infiltration will be equivalent to the infiltration to the capped still bottoms area added on to the infiltration rate to the remaining onsite area for the given scenario. The various infiltration rates are summarized in step 4.

---

Scenario 1

Total infiltration = 1,002 gal/yr + ~~5,900,159~~ 3,160,771 gal/yr = ~~5,901,161~~ 3,161,773 gal/yr

Total volume to be removed = 7,331,600 gal + ~~5,900,159~~ 3,161,773 gal/yr = ~~13,232,761~~ 10,493,373 gallons

$\dfrac{\cancel{13{,}232{,}761}\ 10{,}493{,}373 \text{ gal}}{1 \text{yr}} = \dfrac{\cancel{25.18}\ 19.96 \text{ gpm}}{\cancel{0.80}\ 0.90} = \boxed{\cancel{31.50}\ \text{gpm}}$ 22.20 gpm — pumping rate needed w/ well points and 3 trenches to dewater w/in 1yr.

Assuming 3 trenches are operated at max of 15 gpm the pumping rate of the well point system will need to be ~~31.50 − 18~~ 22.2 − 13.5 = ~~16.5 gpm~~ 8.7 gpm

---

Scenario 2

Total infiltration = 1,002 gal/yr + ~~5,775,000~~ 2,927,187 gal/yr = ~~5,756,000~~ 2,928,189 gal/yr

Total volume to be removed = 7,331,600 gal + ~~5,756,000~~ 2,928,189 gal = ~~13,087,600~~ 10,259,789 gal.

$\dfrac{\cancel{13{,}087{,}600}\ 10{,}259{,}789 \text{ gal}}{1 \text{yr}} = \dfrac{\cancel{24.90}\ 19.52 \text{ gpm}}{\cancel{0.80}\ 0.90} = \boxed{\cancel{31.12}\ \text{gpm}}$ 21.70 gpm — pumping rate needed w/ well points and 3 trenches to dewater area in 1yr.

Assuming 3 trenches are operated at max of 15 gpm the pumping rate of the well point system will need to be ~~16.12 gpm~~. 8.2 gpm

---

Scenario 3

Total infiltration = 1,002 gal/yr + ~~2,120,582~~ 1,952,058 gal/yr = ~~2,121,584~~ 1,953,060 gal/yr

Total volume to be removed = 7,331,600 gal + ~~2,121,584~~ 1,953,060 gal = ~~9,453,184~~ 9,284,660 gal

$\dfrac{\cancel{9{,}453{,}184}\ 9{,}284{,}660 \text{ gal}}{1 \text{yr}} = \dfrac{\cancel{17.98}\ 17.66 \text{ gpm}}{\cancel{0.80}\ 0.90} = \boxed{\cancel{22.48}\ \text{gpm}}$ 19.63 — pumping rate needed w/ well points and 3 trenches to dewater area in 1 year.

Assuming 3 trenches are operated at max of 15 gpm the pumping rate of the well point system will need to be ~~7.48~~ 6.13 gpm.

MONTGOMERY WATSON

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CHKD. BY ________ DESCRIPTION ________ JOB NO. ________

<u>Scenario 4</u> Total Infiltration = 1,002 gpy + 14,780 gpy = 15,782 gpy

Total volume to be removed = 7,331,600 gal + 15,782 gal = 7,347,382 gal

$7,347,382 \text{ gal/yr} = 13.98 \text{ gpm}/0.80 = \boxed{17.47 \text{ gpm}}$, pumping rate needed for whole system

with 3 trenches operating at max of 15 gpm:

Pumping rate of well point system = 2.47 gpm

---

<u>Option 3</u>

<u>Conclusion</u>: With the onsite area isolated from the offsite area by a barrier wall, the dewatering of the onsite area with a well point system and the three trenches is achievable within a year under all 4 scenarios. However, under the first two scenarios the design criteria pumping rate is approached. This means there will likely be no pumping capacity available for dewatering the offsite area. Under the third scenario there is a little more than 10 gpm pumping capacity left in the system. The fourth scenario allows for the most flexibility. The well point system pumping rate could be increased more to dewater the onsite area in less than a year or power could be devoted to dewatering the offsite area simultaneously.

MONTGOMERY WATSON

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CHKD. BY DESCRIPTION JOB NO.

Option 4

Within 1 year the total volume which must be removed to effectively dewater a particular area

equals → $\boxed{\text{Infiltration water} + \text{Existing water} = \text{total volume}}$

$\frac{\text{total volume}}{1\text{yr}} \div \cancel{0.80}\ 0.90 =$ Pumping rate required assuming ~~80%~~ 90% efficiency of pumps.

Sheet pile enclosed Area → Total Volume = 2,696,328 gal/yr. + 1,683,000 gallons = 4,379,328 gallons

To dewater 4,379,328 gallons in 1yr you need a pumping rate of:

$\frac{4{,}379{,}328\ \text{gal}}{1\text{yr}} = 8.33\ \text{gal/min} / \cancel{0.80}\ 0.90 = \boxed{\cancel{10.41}\ 9.26\ \text{gal/min}}$ — Pumping rate necessary to dewater area within sheetpile & offset 1yr of infiltration.

The remaining area outside the sheetpile can be determined. Then add infiltration to the onsite area.

$\boxed{V_{onsite} - V_{sheet\ pile} = V_{remaining}}$

$V_{remaining} + V_{infiltration} =$ Volume to be dewatered.

7,331,600 gallons − 1,683,000 gallons = $\boxed{5{,}648{,}600\ \text{gallons}}$ — This is the volume remaining in the rest of the onsite area.

The infiltration to the remaining on site area varies depending upon which cap is selected. Below the total volume remaining, which was calculated above, shall be added to the infiltration for each scenario and a corresponding pumping rate shall be developed in a manner similar as to what was done above.

---

Scenario 1: ~~5,900,159~~ 3,160,771 gal/yr + 5,648,600 gal = (~~11,548,759~~ 8,809,371 gallons) — This is the volume to be dewatered.

$\frac{\cancel{11{,}548{,}759}\ 8{,}809{,}371\ \text{gallons}}{1\text{yr}} = \boxed{\cancel{21.97}\ 16.76\ \text{gal/min}}$ This pumping rate is higher than can be achieved by the three trenches because they can can only pump at 5gpm.

Maximum pumping capacity of three trenches = 15 gpm.

At 15 gpm the time to dewater the area outside the sheetpile is equal to: $\frac{\cancel{11{,}548{,}759}\ 8{,}809{,}371\ \text{gal}}{15\ \text{gal/min}} = \cancel{764{,}917}\ 652{,}546$ minutes = ~~1.46~~ 1.24 years

15 gal/min × ~~0.80~~ 0.90 = ~~12.0~~ 13.5 gal/min ~ maximum pumping of all 3 trenches at ~~80%~~ 90% efficiency.

EN 15 (10/78)

Scenario 2: $\cancel{5,755,000}$ 2,927,187 gal/yr + 5,648,600 gal = $\boxed{\cancel{11,403,600\text{ gal}}}$ 8,575,787 = Volume to be dewatered.

$\frac{\cancel{11,403,600} \; 8,575,787 \text{ gal/yr}}{} = \boxed{\cancel{21.69}\text{ gal/min}}$ 16.32

This pumping rate is higher than can be achieved by the three trenches.

Maximum pumping capacity of three trenches = 15 gpm

time to dewater = $\frac{\cancel{11,403,600} \; 8,575,787 \text{ gal}}{15 \text{ gpm} \; \cancel{11 \text{ gpm}} \; 13.5} = \cancel{1.45}$ 1.21 years

---

Scenario 3: $\cancel{2,120,582}$ 1,952,068 gal/yr + 5,648,600 gal = $\boxed{\cancel{7,769,182}\text{ gal}}$ $\cancel{7,600,668}$ = Volume to be dewatered

$\frac{\cancel{7,769,182}\text{ gal/yr}}{7,600,668} = \cancel{14.78}$ 14.46 gal/min $/ \cancel{0.80}$ 0.90 = $\cancel{18.48}$ 16.07 gpm ~ Not achievable assuming trenches only ~~80%~~ 90 efficient.

May be achievable with the three trenches.

$\frac{7,600,668}{13.5 \text{ gpm}} = 1.07$ yrs

---

Scenario 4: 14,780 gal/yr + 5,648,600 gal = 5,663,380 gal

$\frac{5,663,380 \text{ gal}}{1 \text{ yr}} = 10.77$ gal/min $/ 0.80 = 13.47$ gal/min ~ achievable even with three trenches operating at only 80% efficiency.

$\frac{5,663,380 \text{ gal}}{12.0 \text{ gpm}} = 0.90$ years to dewater with trenches at 80% efficiency

Option 4 Conclusion: The area enclosed within the sheetpile can be effectively dewatered in one year at a pumping rate of ~~10.41~~ 9.26 gpm assuming the pumps are only 80% efficient.

In order to dewater the area outside of the sheet pile with only three trenches within one year it will be necessary to pave 30% of the area and cap the remaining 70% of the area and seed it with grass. Even with the extensive capping plan of the on-site area and scenario 4 the 3 trenches will need to be operated at nearly maximum capacity in order to effectively dewater the remaining outside area.

**MONTGOMERY WATSON**

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CHKD. BY ______ DESCRIPTION Amendment to Option 4 JOB NO. ____________

Option 4

HELP filename: sheet.out, pg 6

If we consider infiltration to the sheetpile using the HELP model the quantity of infiltration is equal to 1461 $ft^3$/yr = 10,928 gal/yr. Most of the precipitation that falls in the sheetpile enclosed area evaporates (99.5%). This is because the rate of percolation into the packed clay is very slow. The majority of the water ponds on the surface and over time is lost to evaporation.

Total volume within sheet pile area = existing water + infiltrating water

from pg. 2

= 1,683,000 gallons + 10,928 gal/yr

Total volume = 1,693,928 gallons

To dewater 1,693,928 gallons in 1 year you need a pumping rate of:

$$\frac{1{,}693{,}928 \text{ gal}}{1 \text{ yr}} = 3.22 \text{ gpm} / 0.80 = \boxed{4.03 \text{ gpm}}$$

EN 1S (10/78)

MONTGOMERY WATSON

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CHKD. BY DESCRIPTION JOB NO.

Option 5 Install the sheetpile with the well points inside and operate the 8 trenches outside the sheet pile area. Do not install the separation barrier.

Volume of water existing in sheet pile area = 1,683,000 gallons
Volume of water in remaining onsite area = 5,648,600 gallons
Volume of water in offsite area = 7,412,600 gallons

Total Volume to be removed from outside the sheetpile area = 5,648,600 gal + 7,412,600 gal = 13,061,200 gallo

As determined in option 4 the pumping rate required to dewater the area inside the sheetpile within one year is 10.41 gal/min.

Remaining pumping capacity = 24.6 gpm × 0.80 = 19.68 gpm assuming 80% efficiency

The rest of the ACS site will be dewatered by the 8 trenches located around the site.

Volume to be dewatered within 1 year = 13,061,200 gallons + infiltration

The infiltration will vary depending upon which capping scenario is chosen.

total infiltration = "other" onsite infiltration + offsite ~~area infiltration~~. so small relative to onsite that it is negligible.

(see pg. 8 for infiltration data

Scenario 1

total infiltration = 11.22 gpm

$$\text{time to dewater} = \frac{\text{total volume outside sheetpile}}{(\text{remaining pumping capacity}) - (\text{infiltration})}$$

$$\text{time to dewater} = \frac{13,061,200 \text{ gal}}{19.68 \text{ gpm} - 11.22 \text{ gpm}} = \boxed{2.94 \text{ years}}$$

Scenario 2

total infiltration = 10.99 gpm

$$\text{time to dewater} = \frac{13,061,200 \text{ gal}}{19.68 \text{ gpm} - 10.99 \text{ gpm}} = \boxed{2.86 \text{ years}}$$

Scenario 3

total infiltration = 4.03 gpm

$$\text{time to dewater} = \frac{13,061,200 \text{ gal}}{(19.68 - 4.03) \text{ gpm}} = \boxed{1.59 \text{ years}}$$

Scenario 4

total infiltration = 0.028 gpm + 0.004 gpm = 0.032 gpm

$$\text{time to dewater} = \frac{13,061,200 \text{ gal}}{19.68 \text{ gpm} - 0.032 \text{ gpm}} = \boxed{1.26 \text{ years}}$$

EN 1S (10/78)

MONTGOMERY WATSON

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CHKD. BY _______ DESCRIPTION ________________ JOB NO. ____________

Option 5 Conclusion The area inside the sheetpile can be completely dewatered in one year at a pumping rate of 10.41 gpm. The rest of the ACS site cannot be dewatered in any time less than a year with the remaining pumping capacity and stay within the design criteria pumping rate of 35 gpm.

EN 1S (10/78)

MONTGOMERY WATSON

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**Option 6** De water the entire ACS site with well point system installed around contaminated still bottoms area.

Total Volume of existing water to be removed = 14,744,200 gallons. (see pg. 2 for volumes)

Infiltration rate to site depends upon the capping scenario selected.

---

**Scenario 1** total infiltration to site = 11.23 gpm = 5,902,488 gal/yr (From option 1 calcs)

total volume to be removed in 1yr = 14,744,200 gal + 5,902,488 gal

= 20,646,688 gal.

pumping rate required to remove total in 1 yr = $\frac{20,646,688 \text{ gal}}{1 \text{yr}}$ = 39.28 gpm / 0.80 = $\boxed{49.10 \text{ gp}}$

---

**Scenario 2** total infiltration rate = 11.00 gpm = 5,781,600 gpy

total to be removed in 1yr = 14,744,200 gal + 5,781,600 gpy = 20,525,800 gal

pumping rate necessary to dewater in 1 yr = $\frac{20,525,800 \text{ gal}}{1 \text{yr}}$ = 39.05 gpm / 0.80 = $\boxed{48.82 \text{ gpm}}$

---

**Scenario 3** total infiltration rate = 4.04 gpm = 2,123,424 gpy

total to be removed in 1yr = 14,744,200 gal + 2,123,424 gal = 16,867,624 gal

pumping rate necessary to dewater in 1yr = $\frac{16,867,624 \text{ gal}}{1 \text{yr}}$ = 32.10 gpm / 0.80 = $\boxed{40.12 \text{ gpm}}$

---

**Scenario 4** total infiltration rate = 0.034 gpm = 17,870 gpy

total to be removed in 1yr = 14,744,600 gal + 17,870 gal = 14,762,470 gal

pumping rate necessary to dewater in 1yr = $\frac{14,762,470 \text{ gal}}{1 \text{yr}}$ = 28.10 gpm / 0.80 = $\boxed{35.11 \text{ gpm}}$

**Option 6 Conclusion** The entire site cannot be dewatered in less than 1 year using a well point system and remain within the design criteria pumping rate. Only in the fourth scenario can the entire site be dewatered in nearly as short a time as one year and remain at the design pumping rate of 35.0 gpm.

# Appendix D – HELP Model results

Table 2. HELP4 Results for Modeled Scenarios
ACS NPL Site

| Trial Cover Design Number and Description | | Average Annual Totals inches | cubic feet | percent | Peak Daily Values inches | cubic feet |
|---|---|---|---|---|---|---|
| **Offsite Cap Design** | | | | | | |
| Cap 1 - Standard RCRA Model Cap | (6"OL, 18"ML, 12"SP, FML, 24"CL) | | | | | |
| Precipitation | | 34.15 | 647,013 | 100 | 4.64 | 87,921 |
| Runoff | | 2.86 | 62,407 | 8.39 | 2.06 | 44,851 |
| Evapotranspiration | | 25.47 | 554,649 | 74.58 | -- | -- |
| Percolation Through Cover | | 0.00021 | 4.65 | 0.00062 | 0.00046 | 10.11 |
| Lateral Drainage Collected | | 5.8 | 126,345 | 16.99 | 0.03 | 651 |
| Cap 2 - Alternative Cap | (6"OL, 18"ML, Geosynthetic, FML, GCL, 12"CL) | | | | | |
| Precipitation | | 34.15 | 647,013 | 100 | 4.64 | 87,921 |
| Runoff | | 5.17 | 112,633 | 15.15 | 2.27 | 49,451 |
| Evapotranspiration | | 28.97 | 630,898 | 84.83 | -- | -- |
| Percolation Through Cover | | 0.0038 | 83.08 | 0.011 | 0.00022 | 4.71 |
| Cap 3 - Alternative Cap | (6"OL, 12"ML, 0.2" FML, 12"CL) | | | | | |
| Precipitation | | 34.15 | 743,693 | 100 | 4.64 | 101,059 |
| Runoff | | 5.17 | 112,659 | 15.15 | 2.27 | 49,439 |
| Evapotranspiration | | 28.97 | 630,903 | 84.8 | -- | -- |
| Percolation Through Cover | | 0.0034 | 73.6 | 0.0099 | 0.00026 | 5.68 |
| **Offsite Cover Design** | | | | | | |
| Offsite cover - Cover Area Limiting Rainfall Infiltration | (6" OL, 12"CL) | | | | | |
| Precipitation | | 34.15 | 867,642 | 100 | 4.64 | 117,902 |
| Runoff | | 7.761 | 197,206 | 22.73 | 3.53 | 89,879 |
| Evapotranspiration | | 25.07 | 636,995 | 73.42 | -- | -- |
| Percolation Through Cover | | 1.32 | 33,441 | 3.85 | 0.01 | 259 |

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
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PRECIPITATION DATA FILE:      C:\HELP4\ACSrain.D4
TEMPERATURE DATA FILE:        C:\HELP4\ACStemp.D7
SOLAR RADIATION DATA FILE:    C:\HELP4\ACSsun.D13
EVAPOTRANSPIRATION DATA:      C:\HELP4\ACSevapo.D11
SOIL AND DESIGN DATA FILE:    C:\HELP4\offcov2#.D10
OUTPUT DATA FILE:             C:\HELP4\offcov2#.OUT


TIME:  11:43     DATE:   8/18/1998


******************************************************************************

     TITLE:  offsite cover

******************************************************************************
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NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
       COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                           LAYER  1
                           --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
   THICKNESS                  =       6.00   INCHES
   POROSITY                   =       0.4530 VOL/VOL
   FIELD CAPACITY             =       0.1900 VOL/VOL
   WILTING POINT              =       0.0850 VOL/VOL
   INITIAL SOIL WATER CONTENT =       0.4530 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =   0.720000011000E-03 CM/SEC
 NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
          FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                           LAYER  2
                           --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  16
   THICKNESS                  =       6.00   INCHES
   POROSITY                   =       0.4270 VOL/VOL
   FIELD CAPACITY             =       0.4180 VOL/VOL
   WILTING POINT              =       0.3670 VOL/VOL
   INITIAL SOIL WATER CONTENT =       0.4240 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =   0.100000001000E-06 CM/SEC


                           LAYER  3
                           --------
```

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

| | | | |
|---|---|---|---|
| THICKNESS | = | 6.00 | INCHES |
| POROSITY | = | 0.4270 | VOL/VOL |
| FIELD CAPACITY | = | 0.4180 | VOL/VOL |
| WILTING POINT | = | 0.3670 | VOL/VOL |
| INITIAL SOIL WATER CONTENT | = | 0.4270 | VOL/VOL |
| EFFECTIVE SAT. HYD. COND. | = | 0.100000001000E-06 | CM/SEC |

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 800. FEET.

| | | | |
|---|---|---|---|
| SCS RUNOFF CURVE NUMBER | = | 57.80 | |
| FRACTION OF AREA ALLOWING RUNOFF | = | 100.0 | PERCENT |
| AREA PROJECTED ON HORIZONTAL PLANE | = | 7.000 | ACRES |
| EVAPORATIVE ZONE DEPTH | = | 12.0 | INCHES |
| INITIAL WATER IN EVAPORATIVE ZONE | = | 5.262 | INCHES |
| UPPER LIMIT OF EVAPORATIVE STORAGE | = | 5.280 | INCHES |
| LOWER LIMIT OF EVAPORATIVE STORAGE | = | 2.712 | INCHES |
| INITIAL SNOW WATER | = | 0.000 | INCHES |
| INITIAL WATER IN LAYER MATERIALS | = | 7.824 | INCHES |
| TOTAL INITIAL WATER | = | 7.824 | INCHES |
| TOTAL SUBSURFACE INFLOW | = | 0.00 | INCHES/YEAR |

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CHICAGO ILLINOIS

| | | |
|---|---|---|
| STATION LATITUDE | = | 41.78 DEGREES |
| MAXIMUM LEAF AREA INDEX | = | 3.50 |
| START OF GROWING SEASON (JULIAN DATE) | = | 117 |
| END OF GROWING SEASON (JULIAN DATE) | = | 290 |
| EVAPORATIVE ZONE DEPTH | = | 12.0 INCHES |
| AVERAGE ANNUAL WIND SPEED | = | 10.30 MPH |
| AVERAGE 1ST QUARTER RELATIVE HUMIDITY | = | 71.00 % |
| AVERAGE 2ND QUARTER RELATIVE HUMIDITY | = | 65.00 % |
| AVERAGE 3RD QUARTER RELATIVE HUMIDITY | = | 70.00 % |
| AVERAGE 4TH QUARTER RELATIVE HUMIDITY | = | 72.00 % |

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CHICAGO ILLINOIS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

| JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|
| 1.60 | 1.31 | 2.59 | 3.66 | 3.15 | 4.08 |
| 3.63 | 3.53 | 3.35 | 2.28 | 2.06 | 2.10 |

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CHICAGO ILLINOIS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

| JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|
| 21.40 | 26.00 | 36.00 | 48.80 | 59.10 | 68.60 |
| 73.00 | 71.90 | 64.70 | 53.50 | 39.80 | 27.70 |

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CHICAGO ILLINOIS
AND STATION LATITUDE = 41.78 DEGREES

*******************************************************************************

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

| | JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|---|
| **PRECIPITATION** | | | | | | |
| TOTALS | 1.51 | 1.36 | 2.62 | 3.62 | 3.12 | 4.39 |
| | 4.02 | 3.61 | 3.26 | 2.35 | 2.23 | 2.07 |
| STD. DEVIATIONS | 0.65 | 0.69 | 1.12 | 1.58 | 1.43 | 2.05 |
| | 1.99 | 1.85 | 1.76 | 1.34 | 1.21 | 1.03 |
| **RUNOFF** | | | | | | |
| TOTALS | 0.397 | 1.146 | 2.538 | 1.294 | 0.159 | 0.218 |
| | 0.209 | 0.164 | 0.286 | 0.259 | 0.512 | 0.581 |
| STD. DEVIATIONS | 0.600 | 0.874 | 1.644 | 1.364 | 0.467 | 0.596 |
| | 0.590 | 0.556 | 0.735 | 0.699 | 0.853 | 0.794 |
| **EVAPOTRANSPIRATION** | | | | | | |
| TOTALS | 0.532 | 0.437 | 0.766 | 2.960 | 3.494 | 4.257 |
| | 3.855 | 3.396 | 2.323 | 1.421 | 1.027 | 0.602 |

| | | | | | | |
|---|---|---|---|---|---|---|
| STD. DEVIATIONS | 0.117 | 0.103 | 0.501 | 0.768 | 1.019 | 1.364 |
| | 1.545 | 1.484 | 0.985 | 0.333 | 0.208 | 0.179 |

PERCOLATION/LEAKAGE THROUGH LAYER 3

| | | | | | | |
|---|---|---|---|---|---|---|
| TOTALS | 0.0073 | 0.0010 | 0.0531 | 0.2168 | 0.2107 | 0.0696 |
| | 0.0591 | 0.0606 | 0.0818 | 0.1817 | 0.2183 | 0.1561 |
| STD. DEVIATIONS | 0.0214 | 0.0038 | 0.0715 | 0.0604 | 0.0449 | 0.0583 |
| | 0.0589 | 0.0576 | 0.0813 | 0.1027 | 0.0981 | 0.0911 |

---

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

---

DAILY AVERAGE HEAD ON TOP OF LAYER 3

| | | | | | | |
|---|---|---|---|---|---|---|
| AVERAGES | 0.1796 | 0.0182 | 1.8780 | 7.7384 | 6.4199 | 2.1551 |
| | 1.8326 | 1.8820 | 2.7254 | 6.1098 | 7.9177 | 5.2099 |
| STD. DEVIATIONS | 0.6463 | 0.1510 | 2.6144 | 2.2432 | 1.8395 | 1.9762 |
| | 1.9555 | 1.8959 | 2.9000 | 3.7935 | 3.8993 | 3.3575 |

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

| | INCHES | CU. FEET | PERCENT |
|---|---|---|---|
| PRECIPITATION | 34.15 ( 5.545) | 867642.2 | 100.00 |
| RUNOFF | 7.761 ( 2.9651) | 197205.69 | 22.729 |

| | | | | |
|---|---|---|---|---|
| EVAPOTRANSPIRATION | 25.069 | ( 3.3562) | 636995.06 | 73.417 |
| PERCOLATION/LEAKAGE THROUGH LAYER 3 | 1.31607 | ( 0.33394) | 33441.355 | 3.85428 |
| AVERAGE HEAD ON TOP OF LAYER 3 | 3.672 | ( 1.033) | | |
| CHANGE IN WATER STORAGE | 0.000 | ( 1.4807) | 0.00 | 0.000 |

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

| | (INCHES) | (CU. FT.) |
|---|---|---|
| PRECIPITATION | 4.64 | 117902.398 |
| RUNOFF | 3.537 | 89879.2812 |
| PERCOLATION/LEAKAGE THROUGH LAYER 3 | 0.010205 | 259.30365 |
| AVERAGE HEAD ON TOP OF LAYER 3 | 12.000 | |
| SNOW WATER | 7.00 | 177995.0000 |
| MAXIMUM VEG. SOIL WATER (VOL/VOL) | 0.4400 | |
| MINIMUM VEG. SOIL WATER (VOL/VOL) | 0.2260 | |

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FINAL WATER STORAGE AT END OF YEAR 100

| LAYER | (INCHES) | (VOL/VOL) |
|---|---|---|
| 1 | 2.7180 | 0.4530 |
| 2 | 2.5440 | 0.4240 |
| 3 | 2.5620 | 0.4270 |
| SNOW WATER | 0.000 | |

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:      C:\HELP4\ACSrain.D4
TEMPERATURE DATA FILE:        C:\HELP4\ACStemp.D7
SOLAR RADIATION DATA FILE:    C:\HELP4\ACSsun.D13
EVAPOTRANSPIRATION DATA:      C:\HELP4\ACSevapo.D11
SOIL AND DESIGN DATA FILE:    C:\HELP4\capoff1.D10
OUTPUT DATA FILE:             C:\HELP4\capoff1.OUT


TIME:   9:51     DATE:   7/30/1998


******************************************************************************

     TITLE:  offsite cap #1 - standard RCRA cap

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1
--------

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

| | | |
|---|---|---|
| THICKNESS | = | 6.00 INCHES |
| POROSITY | = | 0.4530 VOL/VOL |
| FIELD CAPACITY | = | 0.1900 VOL/VOL |
| WILTING POINT | = | 0.0850 VOL/VOL |
| INITIAL SOIL WATER CONTENT | = | 0.2901 VOL/VOL |
| EFFECTIVE SAT. HYD. COND. | = | 0.720000011000E-03 CM/SEC |

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 4.63 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2
--------

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 9

| | | |
|---|---|---|
| THICKNESS | = | 18.00 INCHES |
| POROSITY | = | 0.5010 VOL/VOL |
| FIELD CAPACITY | = | 0.2840 VOL/VOL |
| WILTING POINT | = | 0.1350 VOL/VOL |
| INITIAL SOIL WATER CONTENT | = | 0.3304 VOL/VOL |
| EFFECTIVE SAT. HYD. COND. | = | 0.190000006000E-03 CM/SEC |

LAYER 3
--------

```
             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   1
THICKNESS                 =     12.00   INCHES
POROSITY                  =      0.4170 VOL/VOL
FIELD CAPACITY            =      0.0450 VOL/VOL
WILTING POINT             =      0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.1944 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.999999978000E-02 CM/SEC
SLOPE                     =      2.00   PERCENT
DRAINAGE LENGTH           =    550.0    FEET


                        LAYER  4
                        --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER  36
THICKNESS                 =      0.20   INCHES
POROSITY                  =      0.0030 VOL/VOL
FIELD CAPACITY            =      0.0020 VOL/VOL
WILTING POINT             =      0.0010 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0030 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.399999993000E-12 CM/SEC


                        LAYER  5
                        --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  16
THICKNESS                 =     24.00   INCHES
POROSITY                  =      0.4270 VOL/VOL
FIELD CAPACITY            =      0.4180 VOL/VOL
WILTING POINT             =      0.3670 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT    =       0.4180 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.100000001000E-06 CM/SEC
```

## GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 550. FEET.

| | | | |
|---|---|---|---|
| SCS RUNOFF CURVE NUMBER | = | 58.90 | |
| FRACTION OF AREA ALLOWING RUNOFF | = | 100.0 | PERCENT |
| AREA PROJECTED ON HORIZONTAL PLANE | = | 6.000 | ACRES |
| EVAPORATIVE ZONE DEPTH | = | 18.0 | INCHES |
| INITIAL WATER IN EVAPORATIVE ZONE | = | 5.984 | INCHES |
| UPPER LIMIT OF EVAPORATIVE STORAGE | = | 8.730 | INCHES |
| LOWER LIMIT OF EVAPORATIVE STORAGE | = | 2.130 | INCHES |
| INITIAL SNOW WATER | = | 0.000 | INCHES |
| INITIAL WATER IN LAYER MATERIALS | = | 20.053 | INCHES |
| TOTAL INITIAL WATER | = | 20.053 | INCHES |
| TOTAL SUBSURFACE INFLOW | = | 0.00 | INCHES/YEAR |

## EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CHICAGO ILLINOIS

| | | |
|---|---|---|
| STATION LATITUDE | = | 41.78 DEGREES |
| MAXIMUM LEAF AREA INDEX | = | 3.50 |
| START OF GROWING SEASON (JULIAN DATE) | = | 117 |

| | | |
|---|---|---|
| END OF GROWING SEASON (JULIAN DATE) | = | 290 |
| EVAPORATIVE ZONE DEPTH | = | 18.0 INCHES |
| AVERAGE ANNUAL WIND SPEED | = | 10.30 MPH |
| AVERAGE 1ST QUARTER RELATIVE HUMIDITY | = | 71.00 % |
| AVERAGE 2ND QUARTER RELATIVE HUMIDITY | = | 65.00 % |
| AVERAGE 3RD QUARTER RELATIVE HUMIDITY | = | 70.00 % |
| AVERAGE 4TH QUARTER RELATIVE HUMIDITY | = | 72.00 % |

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CHICAGO ILLINOIS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

| JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|
| 1.60 | 1.31 | 2.59 | 3.66 | 3.15 | 4.08 |
| 3.63 | 3.53 | 3.35 | 2.28 | 2.06 | 2.10 |

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CHICAGO ILLINOIS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

| JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|
| 21.40 | 26.00 | 36.00 | 48.80 | 59.10 | 68.60 |
| 73.00 | 71.90 | 64.70 | 53.50 | 39.80 | 27.70 |

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CHICAGO ILLINOIS
AND STATION LATITUDE = 41.78 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

| | JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|---|
| **PRECIPITATION** | | | | | | |
| TOTALS | 1.51 | 1.36 | 2.62 | 3.62 | 3.12 | 4.39 |
| | 4.02 | 3.61 | 3.26 | 2.35 | 2.23 | 2.07 |
| STD. DEVIATIONS | 0.65 | 0.69 | 1.12 | 1.58 | 1.43 | 2.05 |
| | 1.99 | 1.85 | 1.76 | 1.34 | 1.21 | 1.03 |
| **RUNOFF** | | | | | | |
| TOTALS | 0.138 | 0.542 | 1.556 | 0.480 | 0.000 | 0.000 |
| | 0.000 | 0.001 | 0.000 | 0.000 | 0.009 | 0.139 |
| STD. DEVIATIONS | 0.338 | 0.553 | 1.357 | 0.912 | 0.000 | 0.001 |
| | 0.001 | 0.008 | 0.000 | 0.000 | 0.089 | 0.367 |
| **EVAPOTRANSPIRATION** | | | | | | |
| TOTALS | 0.532 | 0.443 | 0.754 | 2.963 | 3.650 | 4.590 |
| | 3.961 | 3.490 | 2.298 | 1.302 | 0.908 | 0.574 |
| STD. DEVIATIONS | 0.115 | 0.102 | 0.461 | 0.763 | 1.040 | 1.414 |
| | 1.624 | 1.517 | 0.978 | 0.283 | 0.198 | 0.159 |
| **LATERAL DRAINAGE COLLECTED FROM LAYER 3** | | | | | | |
| TOTALS | 0.4333 | 0.3435 | 0.3742 | 0.5737 | 0.6567 | 0.5909 |
| | 0.5613 | 0.5087 | 0.4434 | 0.4287 | 0.4185 | 0.4681 |

```
  STD. DEVIATIONS       0.1876   0.1605   0.1782   0.1514   0.1258   0.1274
                        0.1466   0.1532   0.1493   0.1651   0.1728   0.1921

PERCOLATION/LEAKAGE THROUGH LAYER  4
------------------------------------
  TOTALS                0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                        0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

  STD. DEVIATIONS       0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                        0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

PERCOLATION/LEAKAGE THROUGH LAYER  5
------------------------------------
  TOTALS                0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                        0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

  STD. DEVIATIONS       0.0001   0.0000   0.0001   0.0001   0.0001   0.0001
                        0.0001   0.0001   0.0001   0.0000   0.0001   0.0001


-------------------------------------------------------------------------------
              AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


DAILY AVERAGE HEAD ON TOP OF LAYER  4
-------------------------------------
  AVERAGES              7.0786   5.9349   6.1762  11.0068  12.3774  10.7538
                        9.4674   8.2271   7.2930   7.1169   7.5908   8.2258

  STD. DEVIATIONS       3.5528   2.8405   3.6069   4.9942   5.1907   4.0893
                        3.5530   2.9483   2.6767   3.8080   5.5017   5.1575

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

| | INCHES | | CU. FEET | PERCENT |
|---|---|---|---|---|
| PRECIPITATION | 34.15 | ( 5.545) | 743693.3 | 100.00 |
| RUNOFF | 2.865 | ( 1.7973) | 62406.71 | 8.391 |
| EVAPOTRANSPIRATION | 25.466 | ( 3.5820) | 554648.81 | 74.580 |
| LATERAL DRAINAGE COLLECTED FROM LAYER 3 | 5.80098 | ( 1.37673) | 126345.242 | 16.98889 |
| PERCOLATION/LEAKAGE THROUGH LAYER 4 | 0.00021 | ( 0.00007) | 4.680 | 0.00063 |
| AVERAGE HEAD ON TOP OF LAYER 4 | 8.437 | ( 2.753) | | |
| PERCOLATION/LEAKAGE THROUGH LAYER 5 | 0.00021 | ( 0.00023) | 4.647 | 0.00062 |
| CHANGE IN WATER STORAGE | 0.013 | ( 3.0327) | 287.96 | 0.039 |

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

| | (INCHES) | (CU. FT.) |
|---|---|---|
| PRECIPITATION | 4.64 | 101059.195 |
| RUNOFF | 2.059 | 44850.5625 |

```
DRAINAGE COLLECTED FROM LAYER  3            0.02987        650.55591

PERCOLATION/LEAKAGE THROUGH LAYER  4        0.000002         0.05352

AVERAGE HEAD ON TOP OF LAYER  4            35.919

MAXIMUM HEAD ON TOP OF LAYER  4            45.921

LOCATION OF MAXIMUM HEAD IN LAYER  3
      (DISTANCE FROM DRAIN)               202.6 FEET

PERCOLATION/LEAKAGE THROUGH LAYER  5        0.000464        10.10889

SNOW WATER                                  7.00        152567.1410


MAXIMUM VEG. SOIL WATER (VOL/VOL)                   0.4850

MINIMUM VEG. SOIL WATER (VOL/VOL)                   0.1183


 ***  Maximum heads are computed using McEnroe's equations.  ***

      Reference:  Maximum Saturated Depth over Landfill Liner
                  by Bruce M. McEnroe, University of Kansas
                  ASCE Journal of Environmental Engineering
                  Vol. 119, No. 2, March 1993, pp. 262-270.

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                FINAL WATER STORAGE AT END OF YEAR  100
```

-------------------------------------------------------------------------

| LAYER | (INCHES) | (VOL/VOL) |
|---|---|---|
| 1 | 2.7180 | 0.4530 |
| 2 | 5.9650 | 0.3314 |
| 3 | 2.6598 | 0.2217 |
| 4 | 0.0006 | 0.0030 |
| 5 | 10.0317 | 0.4180 |
| SNOW WATER | 0.000 | |

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**                                                                        **
**                                                                        **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE             **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)              **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                 **
**                    USAE WATERWAYS EXPERIMENT STATION                   **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY            **
**                                                                        **
**                                                                        **
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PRECIPITATION DATA FILE:      C:\HELP4\ACSrain.D4
TEMPERATURE DATA FILE:        C:\HELP4\ACStemp.D7
SOLAR RADIATION DATA FILE:    C:\HELP4\ACSsun.D13
EVAPOTRANSPIRATION DATA:      C:\HELP4\ACSevapo.D11
SOIL AND DESIGN DATA FILE:    C:\HELP4\capoff2.D10
OUTPUT DATA FILE:             C:\HELP4\capoff2.OUT


TIME:   9:48     DATE:   7/30/1998


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     TITLE:  offsite cap #2

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NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
         COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                              LAYER  1
                              --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
      THICKNESS                  =      6.00    INCHES
      POROSITY                   =      0.4530 VOL/VOL
      FIELD CAPACITY             =      0.1900 VOL/VOL
      WILTING POINT              =      0.0850 VOL/VOL
      INITIAL SOIL WATER CONTENT =      0.2865 VOL/VOL
      EFFECTIVE SAT. HYD. COND.  = 0.720000011000E-03 CM/SEC
    NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
             FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                              LAYER  2
                              --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   9
      THICKNESS                  =     18.00    INCHES
      POROSITY                   =      0.5010 VOL/VOL
      FIELD CAPACITY             =      0.2840 VOL/VOL
      WILTING POINT              =      0.1350 VOL/VOL
      INITIAL SOIL WATER CONTENT =      0.4955 VOL/VOL
      EFFECTIVE SAT. HYD. COND.  = 0.190000006000E-03 CM/SEC


                              LAYER  3
                              --------
```

```
              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  36
THICKNESS                    =      0.20   INCHES
POROSITY                     =      0.0030 VOL/VOL
FIELD CAPACITY               =      0.0020 VOL/VOL
WILTING POINT                =      0.0010 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0030 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.399999993000E-12 CM/SEC


                         LAYER  4
                         --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                    =      0.25   INCHES
POROSITY                     =      0.7500 VOL/VOL
FIELD CAPACITY               =      0.7470 VOL/VOL
WILTING POINT                =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.6560 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.300000003000E-08 CM/SEC


                         LAYER  5
                         --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  16
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4044 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 550. FEET.

| | | | |
|---|---|---|---|
| SCS RUNOFF CURVE NUMBER | = | 58.90 | |
| FRACTION OF AREA ALLOWING RUNOFF | = | 100.0 | PERCENT |
| AREA PROJECTED ON HORIZONTAL PLANE | = | 6.000 | ACRES |
| EVAPORATIVE ZONE DEPTH | = | 18.0 | INCHES |
| INITIAL WATER IN EVAPORATIVE ZONE | = | 7.633 | INCHES |
| UPPER LIMIT OF EVAPORATIVE STORAGE | = | 8.730 | INCHES |
| LOWER LIMIT OF EVAPORATIVE STORAGE | = | 2.130 | INCHES |
| INITIAL SNOW WATER | = | 0.000 | INCHES |
| INITIAL WATER IN LAYER MATERIALS | = | 15.656 | INCHES |
| TOTAL INITIAL WATER | = | 15.656 | INCHES |
| TOTAL SUBSURFACE INFLOW | = | 0.00 | INCHES/YEAR |

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CHICAGO ILLINOIS

| | | | |
|---|---|---|---|
| STATION LATITUDE | = | 41.78 | DEGREES |
| MAXIMUM LEAF AREA INDEX | = | 3.50 | |
| START OF GROWING SEASON (JULIAN DATE) | = | 117 | |
| END OF GROWING SEASON (JULIAN DATE) | = | 290 | |
| EVAPORATIVE ZONE DEPTH | = | 18.0 | INCHES |

AVERAGE ANNUAL WIND SPEED = 10.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 70.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 72.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CHICAGO ILLINOIS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

| JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|
| 1.60 | 1.31 | 2.59 | 3.66 | 3.15 | 4.08 |
| 3.63 | 3.53 | 3.35 | 2.28 | 2.06 | 2.10 |

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CHICAGO ILLINOIS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

| JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|
| 21.40 | 26.00 | 36.00 | 48.80 | 59.10 | 68.60 |
| 73.00 | 71.90 | 64.70 | 53.50 | 39.80 | 27.70 |

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CHICAGO ILLINOIS AND STATION LATITUDE = 41.78 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

| | JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|---|
| **PRECIPITATION** | | | | | | |
| TOTALS | 1.51 | 1.36 | 2.62 | 3.62 | 3.12 | 4.39 |
| | 4.02 | 3.61 | 3.26 | 2.35 | 2.23 | 2.07 |
| STD. DEVIATIONS | 0.65 | 0.69 | 1.12 | 1.58 | 1.43 | 2.05 |
| | 1.99 | 1.85 | 1.76 | 1.34 | 1.21 | 1.03 |
| **RUNOFF** | | | | | | |
| TOTALS | 0.229 | 0.795 | 2.058 | 1.152 | 0.165 | 0.135 |
| | 0.051 | 0.023 | 0.017 | 0.100 | 0.148 | 0.298 |
| STD. DEVIATIONS | 0.395 | 0.719 | 1.650 | 1.337 | 0.477 | 0.433 |
| | 0.281 | 0.227 | 0.139 | 0.485 | 0.506 | 0.570 |
| **EVAPOTRANSPIRATION** | | | | | | |
| TOTALS | 0.532 | 0.444 | 0.750 | 2.946 | 3.669 | 6.636 |
| | 5.255 | 3.807 | 2.312 | 1.188 | 0.861 | 0.566 |
| STD. DEVIATIONS | 0.115 | 0.102 | 0.457 | 0.736 | 1.013 | 0.557 |
| | 1.917 | 1.752 | 0.963 | 0.216 | 0.185 | 0.151 |
| **PERCOLATION/LEAKAGE THROUGH LAYER 3** | | | | | | |
| TOTALS | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| STD. DEVIATIONS | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

PERCOLATION/LEAKAGE THROUGH LAYER 5

| | | | | | | |
|---|---|---|---|---|---|---|
| TOTALS | 0.0004 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 |
| | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 |
| STD. DEVIATIONS | 0.0008 | 0.0007 | 0.0007 | 0.0007 | 0.0006 | 0.0006 |
| | 0.0006 | 0.0006 | 0.0005 | 0.0005 | 0.0005 | 0.0005 |

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

| | | | | | | |
|---|---|---|---|---|---|---|
| AVERAGES | 6.8298 | 6.1278 | 8.7383 | 17.9848 | 18.8149 | 14.6068 |
| | 8.7411 | 6.9634 | 7.0319 | 8.5146 | 11.2893 | 12.4595 |
| STD. DEVIATIONS | 1.7171 | 0.7025 | 4.0064 | 3.9165 | 1.8539 | 2.7398 |
| | 3.7320 | 2.3759 | 2.9159 | 4.6419 | 5.7656 | 5.4093 |

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

| | INCHES | | CU. FEET | PERCENT |
|---|---|---|---|---|
| PRECIPITATION | 34.15 | ( 5.545) | 743693.3 | 100.00 |
| RUNOFF | 5.171 | ( 2.6145) | 112632.85 | 15.145 |
| EVAPOTRANSPIRATION | 28.967 | ( 3.6084) | 630898.50 | 84.833 |

| | | | | |
|---|---|---|---|---|
| PERCOLATION/LEAKAGE THROUGH LAYER 3 | 0.00027 | ( 0.00004) | 5.892 | 0.00079 |
| AVERAGE HEAD ON TOP OF LAYER 3 | 10.675 | ( 1.746) | | |
| PERCOLATION/LEAKAGE THROUGH LAYER 5 | 0.00381 | ( 0.00728) | 83.079 | 0.01117 |
| CHANGE IN WATER STORAGE | 0.004 | ( 2.6482) | 78.80 | 0.011 |

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

| | (INCHES) | (CU. FT.) |
|---|---|---|
| PRECIPITATION | 4.64 | 101059.195 |
| RUNOFF | 2.270 | 49450.7578 |
| PERCOLATION/LEAKAGE THROUGH LAYER 3 | 0.000002 | 0.03586 |
| AVERAGE HEAD ON TOP OF LAYER 3 | 24.000 | |
| PERCOLATION/LEAKAGE THROUGH LAYER 5 | 0.000216 | 4.70553 |
| SNOW WATER | 7.00 | 152567.1410 |

| | |
|---|---|
| MAXIMUM VEG. SOIL WATER (VOL/VOL) | 0.4850 |
| MINIMUM VEG. SOIL WATER (VOL/VOL) | 0.1183 |

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            FINAL WATER STORAGE AT END OF YEAR  100
      ----------------------------------------------------------------------
                LAYER          (INCHES)        (VOL/VOL)
                -----          --------        ---------
                  1             2.7180           0.4530

                  2             8.6367           0.4798

                  3             0.0006           0.0030

                  4             0.1360           0.5441

                  5             4.5265           0.3772

             SNOW WATER         0.000

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:      C:\HELP4\ACSrain.D4
TEMPERATURE DATA FILE:        C:\HELP4\ACStemp.D7
SOLAR RADIATION DATA FILE:    C:\HELP4\ACSsun.D13
EVAPOTRANSPIRATION DATA:      C:\HELP4\ACSevapo.D11
SOIL AND DESIGN DATA FILE:    C:\HELP4\offcap2.D10
OUTPUT DATA FILE:             C:\HELP4\offcap2.OUT


TIME:   9:11     DATE:   7/30/1998


******************************************************************************

     TITLE:  offsite final cap #3

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NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
         COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                              LAYER  1
                              --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   6
      THICKNESS                    =       6.00   INCHES
      POROSITY                     =       0.4530 VOL/VOL
      FIELD CAPACITY               =       0.1900 VOL/VOL
      WILTING POINT                =       0.0850 VOL/VOL
      INITIAL SOIL WATER CONTENT   =       0.2916 VOL/VOL
      EFFECTIVE SAT. HYD. COND.    =   0.720000011000E-03 CM/SEC
    NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
             FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                              LAYER  2
                              --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   9
      THICKNESS                    =      12.00   INCHES
      POROSITY                     =       0.5010 VOL/VOL
      FIELD CAPACITY               =       0.2840 VOL/VOL
      WILTING POINT                =       0.1350 VOL/VOL
      INITIAL SOIL WATER CONTENT   =       0.5010 VOL/VOL
      EFFECTIVE SAT. HYD. COND.    =   0.190000006000E-03 CM/SEC


                              LAYER  3
                              --------
```

```
          TYPE 3 - BARRIER SOIL LINER
          MATERIAL TEXTURE NUMBER  36
THICKNESS                    =      0.20    INCHES
POROSITY                     =      0.0030 VOL/VOL
FIELD CAPACITY               =      0.0020 VOL/VOL
WILTING POINT                =      0.0010 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0030 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.399999993000E-12 CM/SEC


                    LAYER  4
                    --------

      TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER  16
THICKNESS                    =     12.00    INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4049 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000001000E-06 CM/SEC


        GENERAL DESIGN AND EVAPORATIVE ZONE DATA
        ----------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A
         GOOD STAND OF GRASS, A SURFACE SLOPE OF  2.%
         AND A SLOPE LENGTH OF  550. FEET.

SCS RUNOFF CURVE NUMBER             =      58.90
FRACTION OF AREA ALLOWING RUNOFF    =     100.0    PERCENT
```

```
AREA PROJECTED ON HORIZONTAL PLANE    =     6.000  ACRES
EVAPORATIVE ZONE DEPTH                =    18.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE     =     7.761  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE    =     8.730  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE    =     2.130  INCHES
INITIAL SNOW WATER                    =     0.000  INCHES
INITIAL WATER IN LAYER MATERIALS      =    12.621  INCHES
TOTAL INITIAL WATER                   =    12.621  INCHES
TOTAL SUBSURFACE INFLOW               =     0.00   INCHES/YEAR


            EVAPOTRANSPIRATION AND WEATHER DATA
            -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          CHICAGO              ILLINOIS

     STATION LATITUDE                           = 41.78 DEGREES
     MAXIMUM LEAF AREA INDEX                    =  3.50
     START OF GROWING SEASON (JULIAN DATE)      =   117
     END OF GROWING SEASON (JULIAN DATE)        =   290
     EVAPORATIVE ZONE DEPTH                     = 18.0  INCHES
     AVERAGE ANNUAL WIND SPEED                  = 10.30 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY      = 71.00 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY      = 65.00 %
     AVERAGE 3RD QUARTER RELATIVE HUMIDITY      = 70.00 %
     AVERAGE 4TH QUARTER RELATIVE HUMIDITY      = 72.00 %


 NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    CHICAGO              ILLINOIS

          NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
```

| | | | | | |
|---|---|---|---|---|---|
| 1.60 | 1.31 | 2.59 | 3.66 | 3.15 | 4.08 |
| 3.63 | 3.53 | 3.35 | 2.28 | 2.06 | 2.10 |

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CHICAGO ILLINOIS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

| JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|
| 21.40 | 26.00 | 36.00 | 48.80 | 59.10 | 68.60 |
| 73.00 | 71.90 | 64.70 | 53.50 | 39.80 | 27.70 |

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CHICAGO ILLINOIS
AND STATION LATITUDE = 41.78 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

| | JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|---|
| PRECIPITATION | | | | | | |
| TOTALS | 1.51 | 1.36 | 2.62 | 3.62 | 3.12 | 4.39 |
| | 4.02 | 3.61 | 3.26 | 2.35 | 2.23 | 2.07 |
| STD. DEVIATIONS | 0.65 | 0.69 | 1.12 | 1.58 | 1.43 | 2.05 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1.99 | 1.85 | 1.76 | 1.34 | 1.21 | 1.03 |
| RUNOFF | | | | | | |
| TOTALS | 0.229 | 0.795 | 2.059 | 1.152 | 0.165 | 0.135 |
| | 0.052 | 0.023 | 0.018 | 0.099 | 0.148 | 0.298 |
| STD. DEVIATIONS | 0.395 | 0.719 | 1.649 | 1.337 | 0.477 | 0.433 |
| | 0.283 | 0.227 | 0.142 | 0.482 | 0.506 | 0.570 |
| EVAPOTRANSPIRATION | | | | | | |
| TOTALS | 0.532 | 0.444 | 0.750 | 2.946 | 3.669 | 6.636 |
| | 5.254 | 3.808 | 2.313 | 1.188 | 0.861 | 0.566 |
| STD. DEVIATIONS | 0.115 | 0.102 | 0.457 | 0.736 | 1.013 | 0.557 |
| | 1.918 | 1.752 | 0.963 | 0.216 | 0.185 | 0.151 |
| PERCOLATION/LEAKAGE THROUGH LAYER 3 | | | | | | |
| TOTALS | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| STD. DEVIATIONS | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| PERCOLATION/LEAKAGE THROUGH LAYER 4 | | | | | | |
| TOTALS | 0.0004 | 0.0003 | 0.0004 | 0.0004 | 0.0004 | 0.0004 |
| | 0.0002 | 0.0001 | 0.0001 | 0.0002 | 0.0003 | 0.0003 |
| STD. DEVIATIONS | 0.0009 | 0.0008 | 0.0008 | 0.0007 | 0.0007 | 0.0006 |
| | 0.0004 | 0.0002 | 0.0003 | 0.0005 | 0.0006 | 0.0006 |

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AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

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DAILY AVERAGE HEAD ON TOP OF LAYER 3

| | | | | | | |
|---|---|---|---|---|---|---|
| AVERAGES | 3.3923 | 2.5440 | 4.7938 | 12.4125 | 12.8149 | 8.6066 |
| | 2.7432 | 0.9631 | 1.0295 | 2.5138 | 5.2894 | 7.3420 |
| STD. DEVIATIONS | 2.3203 | 1.4015 | 3.7412 | 3.5002 | 1.8545 | 2.7432 |
| | 3.7349 | 2.3731 | 2.9070 | 4.6385 | 5.7646 | 5.5622 |

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

| | INCHES | | CU. FEET | PERCENT |
|---|---|---|---|---|
| PRECIPITATION | 34.15 | ( 5.545) | 743693.3 | 100.00 |
| RUNOFF | 5.173 | ( 2.6122) | 112659.52 | 15.149 |
| EVAPOTRANSPIRATION | 28.967 | ( 3.6094) | 630902.94 | 84.834 |
| PERCOLATION/LEAKAGE THROUGH LAYER 3 | 0.00014 | ( 0.00005) | 2.986 | 0.00040 |
| AVERAGE HEAD ON TOP OF LAYER 3 | 5.370 | ( 1.804) | | |
| PERCOLATION/LEAKAGE THROUGH LAYER 4 | 0.00338 | ( 0.00664) | 73.595 | 0.00990 |
| CHANGE IN WATER STORAGE | 0.003 | ( 2.6475) | 57.34 | 0.008 |

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

| | (INCHES) | (CU. FT.) |
|---|---|---|
| PRECIPITATION | 4.64 | 101059.195 |
| RUNOFF | 2.270 | 49438.8359 |
| PERCOLATION/LEAKAGE THROUGH LAYER 3 | 0.000001 | 0.02699 |
| AVERAGE HEAD ON TOP OF LAYER 3 | 18.000 | |
| PERCOLATION/LEAKAGE THROUGH LAYER 4 | 0.000261 | 5.68639 |
| SNOW WATER | 7.00 | 152567.1410 |

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4850

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1183

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FINAL WATER STORAGE AT END OF YEAR 100

| LAYER | (INCHES) | (VOL/VOL) |
|---|---|---|
| 1 | 2.7180 | 0.4530 |

| | | |
|---|---|---|
| 2 | 5.6308 | 0.4692 |
| 3 | 0.0006 | 0.0030 |
| 4 | 4.5345 | 0.3779 |
| SNOW WATER | 0.000 | |

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